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The Agricultural History Society was organized on February 4, 1919 to promote interest, study, and research in the history of agriculture. Its annual meeting is held in Washington, D. C., in the spring. Literary sessions are also held in connection with the annual meetings of the American Historical Association and the American Farm Economic Association during the last week of December. The Society issued three volumes of *Papers* during 1921–1923. *Agricultural History*, the Society's quarterly journal, was inaugurated in January 1927.

Agricultural History is designed as a medium for the publication of research and documents pertaining to the history of agriculture in all its phases and as a clearing house for information of interest and value to workers in the field. Materials on the history of agriculture in all countries are included, and also materials on institutions, organizations, and sciences which have been factors in agricultural development. The Agricultural History Society assumes no responsibility for statements, whether of fact or of opinion, made by contributors.

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AGRICULTURAL HISTORY AND THE DEPARTMENT OF AGRICULTURE

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Concrete evidences of interest in agricultural history in the Department of Agriculture date back to the beginning of this branch of the Federal Government.[1] There are, in fact, a number of articles in the annual reports of its predecessor, the agricultural division of the United States Patent Office, that may be called history. Some of these early articles were reprintings from unofficial publications; others may have been prepared on request for the Patent Office reports by outsiders; and a few were by staff members who apparently felt that the inclusion of background sketches broadened and enhanced the value of their surveys of current conditions. The series of short articles on cereals by Daniel Jay Browne is an example of the last.

In preparing the first report of the Department of Agriculture, Isaac Newton, the Commissioner of Agriculture, "deemed it not inappropriate to offer some observations on the magnitude of the interests intimately connected with, or growing out of agriculture, the most ancient, the most honorable, and the most indispensable of all the occupations of man, and to give a rapid glance at the improvements which successive ages have wrought in this department of knowledge, and the progress made in our country in later years, as well as the special operations of this department since its organization."[2] Cursory examination of this report reveals it as a curious and not uninteresting compound of historical data and glorification of agriculture. Although an ingratiating bow to Clio, it does not seem to have started a sweeping trend toward emphasis on history in the annual reports of the Department. The historical articles included were similar in character to those in the Patent Office reports. There are, however, at least two that may be considered formal history, namely, Ben: Perley Poore's "History of the Agriculture of the United States" in the *Report* for 1866 and Charles L. Flint's "A Hundred Years' Progress" in the *Report* for 1872.

The first separate publication of a historical nature was James M. Swank's bulletin entitled "The Department of Agriculture: Its History and Objects" which appeared in 1872. In this same decade—the 1870s—the special reports of the Department began to include historical background material. This is especially true in the fields of entomology and animal husbandry. A survey of departmental publications prompts the further generalization that it has been the scientists who have most frequently found it desirable to preface their works with historical introductions.

For over half a century, however, only incidental attention was given to

[1] This paper was presented in slightly condensed form as the presidential address at the annual meeting of the Agricultural History Society, Washington, D. C., June 6, 1940.

[2] U. S. Department of Agriculture, *Report*, 1862, p. 4.

history in the publications of the Department. Its occasional invocation in articles in the annual reports was probably in response to public interest in historical material, while its inclusion as background in reports on special problems clearly shows a deference to perspective and past experience. There were, to be sure, a few extended reports which may be called formal history. The most noteworthy of these is the *Special Report on the History and Present Condition of the Sheep Industry of the United States*, published in 1892. The Department's *Yearbook* for 1899 should also be mentioned as it provides historical appraisals of the various agricultural sciences by leading authorities in the fields covered.

Until the second decade of the present century, however, the interest in agricultural history in the Department is explainable largely in terms of the activities of individual staff members or, at most, of small groups concerned with specific problems. Individual workers, convinced of the value of approaching their current research problems historically, carried on historical investigations as an avocation and published their findings in nonofficial scientific periodicals.

These individuals and small groups became and remained focal points of historical interest. The late Dr. Rodney H. True is a notable example. Although his official responsibility was the direction of physiological research in the Bureau of Plant Industry, he gradually came to be known as the main person in the Department to consult on historical matters. During the later years of his Washington career, he published a number of historical articles which focus on the agricultural and botanical interests of Thomas Jefferson and the locale and persons associated with him. Lyman Carrier was similarly interested in agricultural history, at first primarily because the Office of Forage Crop Investigations found it desirable to develop an index of data relating to the history of forage crops. He prepared a number of studies in connection with this work and later published *The Beginnings of Agriculture in America* (New York, 1923)—a history of American agriculture in the colonial period. Dr. C. A. Browne, long associated with the Bureau of Chemistry and Soils, contributed a valuable series of historical articles, mostly dealing with the history of agricultural chemistry. In the Forest Service, Dr. Herbert A. Smith has been interested for many years in the preservation of all records relating to forestry. To implement this objective, he has served as chairman of the history of forestry committee of the Society of American Foresters since 1937. He has also contributed historical articles to professional journals and official reports. From the long-time view, the Library of the Department is probably the most important of the early focal points. Due to the foresight and diligence of Miss Claribel R. Barnett, special attention was given to the acquisition of all works relating to agriculture that had been issued prior to the establishment of the Library as well as to a comprehensive coverage of current publications. In consequence, the Library is a great national center of research in agricultural history.

Another type of history produced by departmental personnel is what amounts

to formal summaries of the life experiences—plus a backward projection—of eminent authorities in special fields. A notable example is the trilogy prepared by the late Dr. Alfred C. True—*A History of Agricultural Extension Work in the United States, 1785–1923* (1928); *A History of Agricultural Education in the United States, 1785–1925* (1929); and *A History of Agricultural Experimentation and Research in the United States, 1607–1925* (1937). Dr. True entered the Department in 1889 and, by virtue of his particular positions during four decades, was privileged to study intensively from a national viewpoint the growth of the entire modern movement for agricultural education. These monographs, therefore, although severely factual, have a value which can never be approached. True's historical works were issued by the Department of Agriculture. On the other hand, works of a comparable nature, such as Dr. L. O. Howard's *Fighting the Insects* (1933); Dr. Charles J. Galpin's *My Drift into Rural Sociology* (1938); and Dr. David Fairchild's *Exploring for Plants* (1930), and *The World was My Garden* (1938), were published commercially.

In addition to formal historical publications, individuals in the Department have contributed in various ways to outside scholarship. To research workers, they have supplied not only factual data but judgments based on long experience, and a compilation of the articles and books which benefited thereby would be not only lengthy but impressive. Dr. Carleton R. Ball's *Federal, State, and Local Administrative Relationships in Agriculture* (Berkeley, California, 1938) may be cited by way of illustration. Dr. Ball has paid high tribute to members of the departmental staff for their contributions to his administrative history.

Individuals within the Department also provided much of the initiative and enthusiasm in the inauguration of the Agricultural History Society in 1919. Organized to stimulate interest in, promote the study of, and facilitate research and publication on the history of agriculture, the Society has served as a clearing-house for information of interest to workers in the field. Department members have served actively as officers and have contributed articles as well as editorial assistance to *Agricultural History*, the quarterly journal,

The essaying of influences in the realm of germinal beginnings in any given field is usually difficult as well as hazardous. However, agricultural history, both in the Department of Agriculture and in the academic circles, appears to owe a great deal to the University of Wisconsin. It was at this institution that Frederick Jackson Turner prepared his famous essay on "The Significance of the Frontier in American History." First presented in 1893 and amplified by coordinate essays during the author's lifetime, it implied, both in its approach and in its delineation of social and economic evolution, a decided emphasis on the vast nexus of forces which constitute the history of American agriculture. Turner directed many graduate students, first at Wisconsin and after 1910 at Harvard, in research subjects that were agricultural history. These students, in turn, guided many of their students in the same direction. The general atmosphere at Wisconsin also seems to have been conducive to an emphasis on the historical approach to many problems which were the province of other departments.

So far as formal history in the Department of Agriculture is concerned, the influence of Dr. Henry C. Taylor, frequently referred to as the father of agricultural economics, looms large. Taylor's doctoral dissertation in economics at Wisconsin was historical in content, and on a recent occasion, he indicated that it was Turner's classes that had demonstrated to him the value of methods of historical research and of history for economists as well as for students of agriculture generally.

In 1916, Dr. O. C. Stine, who studied under Taylor and also with Turner, began what was formally recognized as history work in the Office of Farm Management of the Department, and he has continued to be administratively responsible for the major part of it ever since. The earlier products of this work tended to be geographical as well as historical and utilized statistical data, summarized by dot maps, to a considerable degree. They are represented by the *Geography of the World's Agriculture*, the cotton section of the *Atlas of American Agriculture*, and the series of historical articles on agricultural commodities in the Yearbooks for 1921 through 1925. Dr. Stine's division also collaborated in the assembling of data for Percy Wells Bidwell and J. I. Falconer's *History of Agriculture in the Northern United States, 1620–1860* and Lewis Cecil Gray's *History of Agriculture in the Southern United States to 1860* which were issued by the Carnegie Institution of Washington in 1925 and 1933, respectively.

Since the early 1920s, Dr. Stine's division has included a small staff which devoted full time to agricultural history. To assist research workers, this group has assembled and maintained a manuscript file, a bibliographical file, a "select miscellany" or collection file, and a distribution file. Portions of these materials have been made generally available by means of bibliographies, articles, and letters in response to special requests. Close contacts with historical and economic associations and with individuals outside the Department have been maintained, and a large number of articles and reviews have been supplied to departmental and other publications. For over a decade, one member of the history staff has offered a course on the history of American agriculture in the Graduate School of the Department.

During the 1930s, formal historical research was inaugurated in other branches of the Department. Recognizing the need for a historical leaven, the division of farm population and rural welfare of the Bureau of Agricultural Economics added a historian, Dr. Paul H. Johnstone, to its staff. The documentary photography of Dr. Roy E. Stryker in the Farm Security Administration is a project of interest to both present and future historians. The Soil Conservation Service's erosion history research, under the direction of Miss Lois Olson, has already produced substantial scholarly contributions as well as many articles of a popular nature to the field.

The growing interest of the Department in history is further reflected in the historical summaries included in the series of topical Yearbooks inaugurated during the Secretaryship of Henry A. Wallace. Those for 1936 and 1937 on "Better Plants and Animals" reported the findings of the survey of superior

germ plasm made by the Secretary's Committee on Genetics. The 1938 *Yearbook* on "Soils and Men" constituted the report of the Committee on Soils. The volume for 1939 on "Food and Life" contained less actual history, but that for 1940 on "Farmers in a Changing World" included an extensive historical survey and chronology.

In the spring of 1939, a series of conferences on the possible contributions of the social sciences to the objectives of the Department were held. There were separate conferences with representatives from the fields of agricultural history, cultural anthropology, philosophy, political science, rural sociology, and social psychology, and special emphasis was given to the place of these sciences in the Bureau of Agricultural Economics, which had been recently reconstituted to serve as the national center of agricultural planning and policy making. The discussion and likewise the report of the Agricultural History Conference focused on the following topics: the value and importance of history, especially with reference to the social and economic problems of agriculture; the sources of special importance for research in agricultural history; the research in agricultural history especially pertinent to the work of the Department and the experiment stations; the ways and means of disseminating agricultural history; and the nature and value of a national museum of agriculture and regional institutions of a similar nature. The proceedings of the conference provides valuable information on agricultural history not only in the Department but in other research centers, and the report is a veritable handbook for research workers for at least a decade—providing the Nation is permitted to remain at peace.

As already stated, the Bureau of Agricultural Economics has become a vast social science research center. Likewise, the bounds for its work in agricultural history are now practically nonexistent, except for human limitations. In consequence, American agricultural history has resolved into practically the approximation of general American history. Furthermore, the requests and needs for data are not limited to the United States—they encompass the history of the other leading countries as well. If any one individual were trained for all of this work, he would have to be something of an anthropologist, archivist, bibliographer, economist, geographer, librarian, and sociologist as well as a historian.

Following this epitome of the history of history in the Department, it is pertinent to consider the utility and need of history in the Department's work. Regardless of divergent points of view or approaches to American history, it remains a fact that farming, together with the accompanying rurality, has been the main way of life in America until relatively recent times. Only since the World War has the urban population outnumbered the rural, and even today the total number of the latter is larger than at any previous period in the Nation's history. Regardless of what the future may hold in store for American agriculture, this basic ruralism will remain a force in the evolution of American civilization for considerable time to come. The vast maze of forces and conditions that have entered into the evolution of rural life constitute a central theme in the history of the American people which cannot be ignored if the past is to

be comprehended and that comprehension utilized for the benefit of the present and future.

Careful investigation and adequate comprehension of the historical development of American agriculture is of vital importance in solving current and future agricultural problems. Although the conditions of today may be somewhat different from those of yesterday, they have been definitely shaped by forces operating in the past. In view of this fact, analyses of the historical backgrounds of present agricultural situations contribute greatly to a satisfactory understanding of them. This applies to the political, social, and economic conditions of a given region or country as well as to specific institutions and organizations. For an understanding of agricultural problems, historical research affords valuable and necessary perspective. It delineates the more permanent forces from the temporary factors and provides the basis for widening the sympathies, steadying the judgment, and enlarging the experience of those who are charged with the task and opportunity of securing for agriculture an adequate place in the life of the Nation.

Specifically, the objective of research in American agricultural history is the careful delineation of the historical background of each and every community, subregion, and region in rural United States. Just as the soil scientists have provided data basic to a comprehensive soil map of the entire country, so the agricultural historians must develop a many dimensional social and economic historical map of rural America. To achieve something approximating a map of this kind, they must collect sources of historical information, analyze the pertinent data embodied therein, and present their findings in written form for use in relation to current problems. If the historians provide these analyses of the economic and social factors which have operated in any given community or region to produce the present situation, the economists and other scientists who are charged with drafting and executing plans for more rational utilization of the natural and human resources of the area can proceed with more comprehension and therefore with more likelihood of success. Finally, but not least in importance, the agricultural historians must give cognizance to the over-all patterns of culture and action into which their subjects fall.

In the actual writing of agricultural history, whether it be an article for popular consumption or a monograph, research workers must have access to the sources from which the data essential for their purpose may be gathered. The sources especially needed have already been considered elsewhere,[3] but there is still the question of the role of the Department with reference to their collection. Archival materials—that is, the vast quantity of records produced by the Department and other Federal agencies in the fulfillment of their functions—are clearly the province of the National Archives. Likewise, the printed mate-

[3] See Everett E. Edwards, "Agricultural Records: Their Nature and Value for Research," *Agricultural History*, 13:1–12 (January 1939), for discussion of the kinds of historical sources of special interest to historians of agriculture. The collecting agencies especially concerned with these sources are indicated in Everett E. Edwards, "The Need of Historical Materials for Agricultural Research." *Agricultural History*, 9:3–11 (January 1935).

rials relating to agriculture are the special concern of the Department Library and its branches. For both these categories of sources, however, it would seem desirable to utilize the special knowledge and judgment of the Department's history staff. It could contribute materially to the writing of administrative and policy histories by assembling a special collection of key records and background material. It could also advise on the basic reference works in history and assist in the gathering of agricultural publications needed to insure the preeminence of the Department Library in its field.

There remains a third category which may be grouped under the general heading of manuscripts. With reference to collecting historical materials, practically the entire country has now evolved into rather definite zones of interest and subject. Furthermore, there is a growing spirit or attitude of cooperation among the collecting agencies, and the ultimate result will be a much more rational distribution than the old rivalry dictated. The Department, if it acquired the funds, could actively collect materials in the field. In so doing, it might disturb the cooperation and rationalization already developed and probably generate some ill will. It can, however, accept materials that come its way; it can stimulate and facilitate the work of the present depositories; and it can develop special collections as is now being so ably done for the history of agricultural economic thought.

Another fundamental question with reference to the history work in the Department concerns the particular research projects to be undertaken.[4] The Agricultural History Conference Report includes a decalog of subjects for research, but there remains the problem of choice for the Department.

Granted that it can have only a limited staff for historical investigation, certain lines of research seem reasonable and obvious: Subjects that are of such pressing concern to the general objectives of the Department that it cannot wait for individual historians to do the research; subjects that cannot, by virtue of their size, be executed by individual research workers; studies that will serve as models for research on comparable subjects to scholars outside the Department; and subjects that are especially appropriate to the training, inclinations, and capacities of the particular personnel detailed to do historical research. Furthermore, it may be added that the history personnel in the Department should be prepared to shift its main interests to accord with the dominating concern of the Department, be it economic depression or "normal" times, the problems of peace or of war.

Closely related to this matter of subjects is methodology. The section in the Department which carries the main load of responsibility for historical research should know the many techniques that have been and are being developed by historians and should be prepared to assist other social scientists with them. Likewise, the section should keep informed on developments in the field of history. The many and varied activities of the Historical Records Survey of the WPA may be cited as an example.

[4] See Everett E. Edwards, "Middle Western Agricultural History as a Field of Research," *Mississippi Valley Historical Review*, 24:315–328 (December 1937).

A large share of the history work of the Department must inevitably take the form of informational service broadly interpreted. By implication, a leadership role for the Department in collecting historical sources and in carrying on research has been suggested. The results are essentially the property of the American people and should be made available in ways and forms usable by them. They crave information and assistance in understanding the world of problems confronting them, and they must have that information and assistance if democracy is to survive and be what Americans have held it to be. To effect these objectives, it is desirable that the Department inaugurate a publication series to serve as a vehicle for the distribution of the results of agricultural history research throughout the Department. Articles, bibliographies, and monographs should be included.

The *Land Policy Review* for January 1940 includes a short article with the intriguing title "78 Farmers Make a Map." The initial paragraph is as follows: "Seventy-eight farmers of Parks County, Indiana, have been drawing a map of their county. They started with memories of what it used to be. They took stock of their problems, resources, and opportunities. They 'wanted to find out where they are before they attempt to determine where they are going.' And they are winding up with a new experience in democratic processes and with conclusions that startle even themselves: That problems of tax delinquency, relief, erosion, declining fertility, and faulty management are linked with their finding that of 280,000 acres in this above-average Indiana county only 112,000 acres should remain in cropland use." Here is the kind of agricultural history that is demonstrably utilitarian, and it is a definite challenge to research workers in the field.

In addition to aiding a democratic process, there is another reason for emphasizing such efforts. Those who have worked on the more comprehensive phases of agricultural history have long since realized that good agricultural history is unobtainable without good local history. Cognizant of the educational program of the 4-H clubs and extension work generally, the Department can cooperate in supplying their needs. Certainly it is a valuable and useful experience to write individually or collectively the history of one's own community. Good local histories can be prepared by school children, and the Department may well assist in a "write your own history" movement.

In conclusion, the question may be asked—How does the Agricultural History Society fit into this picture, so far as the Department is concerned? The Society can serve as a correlating agency for the history work of the various bureaus of the Department in ways that are probably more effective than possible formal interbureau conferences. As a non-official organization it can also assist by doing many things that the Department cannot do officially. The sponsoring of the movement for a national agricultural museum and regional institutions of a similar nature is an example The same is true of collecting manuscript materials. The Society's journal also serves—insofar as its size permits—as a clearinghouse for information of value to all interested in agricultural history.

FRENCH-CANADIAN AGRICULTURE IN THE ST. LAWRENCE VALLEY, 1815–1850

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Even to the casual observer, the valley of the St. Lawrence in the first half of the nineteenth century differed in many respects from Upper Canada, from the northern United States, and even from the English-speaking parts of Lower Canada. It had a quaintness which it has not yet lost. The traveler coming up the St. Lawrence would catch sight of the typical long, narrow farms along the river front more than a hundred miles below Quebec. He would soon see on each bank an endless row of whitewashed dwellings, with a "close and remarkable" resemblance to the peasants' cottages of Normandy,[1] and every few miles, the center of community life, a parish church with "its simple spire, distinguished above the surrounding buildings by its glittering vane and bright roof of tin."[2]

If the traveler left the boat, he could drive by stage through a countryside "perfectly French in every respect; in the appearance of the cottages; the air, language and dress of the peasantry; the sign boards on the shops and taverns; and the Virgin's shrines and crosses by the wayside," and where "nearly every common labourer and boy, though he had no shoes to his feet, wore round his waist a sash of some bright colour, generally red."[3]

It was easy to read romance into the everyday life of the habitants who jingled along the frozen rivers in their red carrioles to chorus the traditional songs of the voyageurs at some festivity;[4] and it was, possibly, equally easy to find in it a realized ideal of peasantry, one which disposed all change, "satisfied to live in quiet and simple comfort, without the worry of improvements."[5] But if the traveler were an experienced old-country farmer who could look beyond the picturesque, or if, being less qualified, he consulted the Montreal or Quebec commission merchants, he would have learned, almost any time between the close of the Napoleonic Wars and mid-century, that the French-Canadians of the seigneuries were undergoing an adjustment in their economy which was exceedingly painful.

Most of the seigneuries occupied by the French-Canadians stretched inland from the banks of the St. Lawrence from the border of Upper Canada eastward to the points where the Precambrian Shield on the north shore and the Notre Dame Mountains on the south shore made settlement impossible. Others were

[1] [Pierre de Sales Laterrière], *Political and Historical Account of Lower Canada*, 113 (London, 1830).

[2] [Catherine Parr Traill], *The Backwoods of Canada*, 15 (London, 1838).

[3] Charles Dickens, *American Notes*, 206 (London and New York, 1908).

[4] "The Canadian settler scorned the name of peasant, and then, as now, was always called the *habitant*."—Francis Parkman, *The Old Régime in Canada*, 303 (rev. ed., Boston, 1895).

[5] E. W. Watkin, *Canada and the United States: Recollections 1851 to 1886*, p. 353 (London 1887).

situated along the banks of tributaries of the St. Lawrence, especially the Richelieu. On these seigneuries the habitants lived from generation to generation, each on his narrow strip, each paying his rent in cash or kind, and each in his lifetime reclaiming a small space from the forest.

In addition to the French-Canadians of the seigneuries, there were three other groups of agriculturists in Lower Canada. In the vicinity of Montreal and at other places advantageously situated with respect to markets, there were Englishmen and Scotsmen, usually men of some capital, who, as early as 1791, had been impressing travelers with their improved agriculture.[6] "The English farmer," Lord Durham wrote, "carried with him the experience and habits of the most improved agriculture in the world. . . . He often took the very farm which the [French-]Canadian settler had abandoned, and, by superior management, made that a source of profit which had only impoverished his predecessor."[7] South of the seigneuries, in the Eastern Townships, were pioneers of British or American extraction, who held their land according to the British system of tenure, and whose agriculture was a reproduction of that of northern New England.[8] Finally, there were some French-Canadian settlements outside the St. Lawrence Valley plain which carried on a limited form of agriculture. In the patches of fertile soil along the rocky Gaspé coast, a scattered population farmed as a sideline to fishing. Again, along the south shore below Trois Pistoles, and even along the north shore—where there was no hinterland whatever and no means of land communication—little communities existed by fishing, trapping, cutting timber, and farming.[9] Though the first two of these groups would claim attention in any general history of Lower-Canadian agriculture, they are omitted, like the third, from consideration in the following treatment of habitant agriculture.

In 1815, a century and a half after the first occupation of the seigneuries, the settlements were never far from the river. In 1813, the country along the St. Lawrence eastward from Quebec "was cleared in a belt ranging from half a mile to three miles in length."[10] About 1816, a traveler reported that "From Quebec to Montreal may be called one long village. On either shore a stripe of land, seldom exceeding a mile in breadth, (except near the streams which fall into the St. Lawrence,) bounded by aboriginal forests . . . represents all that is inhabited of Lower Canada."[11]

[6] P. Campbell, *Travels in the Interior Inhabited Parts of North America in the Years 1791 and 1792*, p. 117–118 (Toronto, 1937).

[7] Sir C. P. Lucas, ed., *Lord Durham's Report on the Affairs of British North America*, 2:36 (Oxford, 1912).

[8] Joseph Bouchette, *The British Dominions in North America*, 1:309 (London, 1832).

[9] *Ibid.*, 1:327–328; A. R. M. Lower, *Settlement and the Forest Frontier in Eastern Canada*, 6 (Toronto, 1936).

[10] New York *Albion*, Nov. 26, 1831, p. 195.

[11] Francis Hall, *Travels in Canada, and the United States, in 1816 and 1817*, p. 124 (London, 1818). Cf. P. Stansbury, *A Pedestrian Tour of Two Thousand Three Hundred Miles in North America*, 159, 208 (New York, 1822); and James Flint, *Letters from America, Containing Observations on the Climate of the Western States, the Manners of the People, the Prospects of Emigrants, etc. etc.*, p. 238 (Cleveland, 1904).

These limited clearances were evidence that the French-Canadians lacked the pushing frontier spirit so characteristic of the Western States, Upper Canada, or the Eastern Townships. The habitants generally, it was remarked, were "far from adventurous; they cling with pertinacity to the spot which gave them birth, and cultivate, with contentedness the little piece of land which, in the division of the family property, has fallen to their share "[12]

In other respects, too, the habitants clung with tenacity to the customs of their ancestors. In nothing was this conservatism more strongly manifested than in their methods of agriculture. The agriculture practiced in the seigneuries in 1815 was, as it had long been, a type of general farming. The crops chiefly grown were the same as those of the early eighteenth century—wheat, oats, and peas. Other crops, such as barley, rye, and buckwheat, were still comparatively insignificant, although more or less generally grown. Indian corn, a standard pioneer crop elsewhere in North America, was of slight importance in Lower Canada; in fact, among the French-Canadians it was seldom used except in the form of roasting ears. Potatoes, which had been scarcely known in New France before the British conquest, were now produced in great quantities.[13] With the exception of wheat, these crops, together with others of less importance such as flax and tobacco, were ordinarily utilized by the habitants on their farms. Wheat alone of their crops could be sold for cash.

To the twentieth-century student, it seems remarkable that wheat could have been regarded as the staple crop of the seigneuries, for with its short growing season, the region is better fitted for pasturage. But wheat had been grown extensively during the French period. After the British conquest, and especially during the Revolutionary and Napoleonic wars, the commission merchants of Quebec encouraged an expansion of acreage by sending out agents who circulated among the habitants buying their grain and building warehouses in the villages along the rivers for storing and shipping it.[14] Wartime demand, with only nascent competition from the new lands along the Great Lakes, made wheat a profitable crop, in spite of rather frequent failures of the harvest, and considerable fluctuations in the market.[15] With a cash income, steady or intermittent, the habitants imperceptibly passed from the stage of economic self-sufficiency, which had been so characteristic of the Old Régime along the St. Lawrence, to one wherein they were buying many of the articles they used.

[12] Laterrière, *Political and Historical Account of Lower Canada*, 120. It was stated in 1826 that, although the population of the seigneuries had quadrupled since 1784, the amount of land under cultivation had increased by only one third.—Lucas, *Lord Durham's Report*, 2:293–294.

[13] John Lambert, *Travels Through Lower Canada and the United States of North America in the Years 1806, 1807 and 1808*, 1:98, 136 (London, 1810); William Evans, *A Treatise on the Theory and Practice of Agriculture, Adapted to the Cultivation and Economy of the Animal and Vegetable Productions of Agriculture in Canada*, 42, 183–184, 187–188 (Montreal, 1835).

[14] F. W. Burton, "The Wheat Supply of New France," Royal Society of Canada, *Transactions*, 30:141–147 (Ottawa, 1936); Isaac Weld, *Travels through the States of North America and the Provinces of Upper and Lower Canada during the Years 1795, 1796 and 1797*, 2:7–8 (ed. 3, London, 1800); Bouchette, *British Dominions*, 2, "St. Denis," "St. Ours."

[15] Lambert, *Travels Through Lower Canada*, 1:100.

About 1830, a writer remarked that the habitant "at one time perhaps entirely produced, whatever he consumed. The introduction of English luxuries, however, has, in some degree, altered this; tea, English broad cloths and calicoes, cutlery &c., now form part of the Canadian's necessaries; though the degree in which he is dependent solely on himself is far greater than that of an English farmer."[16]

The easiest way for the habitants to maintain their new standard of living was to continue to depend on wheat, a choice made inevitable by the fact that the fertile soil of the St. Lawrence and Richelieu valleys had long produced abundantly when the seasons were favorable.[17] By 1815, much of their land had been under cultivation for so many years that it was becoming worn out. Further, the long concentration on wheat had developed certain undesirable concomitant characteristics in the agriculture of the habitants. They had a tendency, like New World farmers in general, to cultivate too much land, and to do it poorly. They gave insufficient emphasis to stock raising, for reasons pointed out later. Above all, they were content with defective methods of tillage; they practiced what Lord Durham called "the worst method of small farming."[18]

Essentially, the habitants used a simple two-year rotation. In this "old French system" it was customary to divide the arable portion of the farm into two nearly equal parts, one part to be sown one year, the other the next. The half to be sown was plowed in the fall if there was time,[19] otherwise in the spring, but usually it was done very badly and harrowed in a slovenly fashion. When it was seeded with wheat (generally a spring variety, as fall wheat in Lower Canada was subject to winter-killing),[20] oats, peas, or perhaps barley, the habitant did not spend his time summer fallowing the idle part of his land, as the advanced British farmer in the Canadas did,[21] but simply left it alone or used it as a pasture. The lack of crop rotation, or even of fallowing, meant that there was no check on the growth of thistles, wild oats, wild mustard, and other weeds. Even as a pasture the idle land was not worth much, for the habitant never sowed either grass or clover seed. In the autumn, it was plowed, and the next year the other part lay idle. "This alternating system is carried on for an indefinite

[16] Laterrière, *Political and Historical Account of Lower Canada*, 127.

[17] H. Y. Hind, and others, *Eighty Years' Progress of British North America*, 52 (Toronto, 1863).

[18] Lucas, *Lord Durham's Report*, 2:28–29. The description which follows is based primarily on the account in *Journal d'Agriculture* (Montreal), août 1850, p. 247–249. It may be confirmed by comparison with Lambert, *Travels*, 1:135; *Journal of the Legislative Assembly of Lower Canada*, 1816, App. E.; *Journal of the Legislative Assembly of Canada, 1850*, App. TT; William Evans, *Review of the Agriculture of Lower Canada with Suggestions for its Amelioration*, 28 ff. (Montreal, 1856); *L'Agriculteur* (Montreal), octobre 1859, p. 25.

[19] The habitants seem usually to have plowed with two yokes of oxen and a horse.—Bouchette, *British Dominions*, 1, "Beauharnois." The oxen were yoked by the horns.—Flint, *Letters from America*, 331; [B. Silliman], *Remarks Made on a Short Tour Between Hartford and Quebec in the Autumn of 1819*, p. 241–242 (ed. 2, New Haven, 1824).

[20] Evans, *Treatise*, 175.

[21] C. F. Greece, *Facts and Observations Respecting Canada and the United States of America*, 95, 101, 106 (London, 1819).

period," declared William Evans, "and I have no doubt it has in some instances been continued for a century or more."[22]

Occasionally a habitant would put little piles of manure on the idle land in summer, where it would leach till fall before it was plowed in, but even this practice was certainly far from general. In fact, as late as 1860, the custom of carting manure on to the ice of a neighboring river to be washed away in the spring, or of removing the barns when the manure accumulated, still prevailed to a considerable extent.[23]

By 1815, the unwelcome results of these farming methods were plainly manifest. From the statistics given by Joseph Bouchette about 1830, it is clear that the amount of wheat grown in all Lower Canada was not greatly in excess of that required for local consumption. The consequence was that the large overseas export of wheat from the Richelieu Valley was almost counterbalanced by the importation of cheap flour from Upper Canada, New York, or Ohio for use in Montreal, Quebec, and elsewhere.[24] In regions once spoken of as "the granaries of Lower Canada," the inhabitants were reduced to producing scarcely enough grain for themselves; and in still others, especially along the lower St. Lawrence, the wheat crops failed year after year.[25]

But worse was to come, both in the comparatively progressive parts of the seigneuries and in the most backward, from the ravages of the worst pest the wheat growers in the Canadas ever had to contend with—the wheat midge.[26] This insect was first noticed in western Vermont in 1820, probably having been brought to Quebec in its larval state in some unthreshed wheat from Europe, and having spread unnoticed southwards. In 1828, 1829, 1832, and 1833, it caused much loss in large areas of Lower Canada, as well as in the adjacent parts of Vermont, New Hampshire, and New York. In 1834, 1835, 1836, and 1839, it occasioned great havoc, not only in the Richelieu Valley, but also "west and northward of Montreal for many miles."[27] Every conceivable means was

[22] Evans, *Treatise*, 29.

[23] *Journal d'Agriculture*, mars 1850, p. 75; *ibid.*, août 1850, p. 247–248; Hind, *Eighty Years' Progress*, 34.

[24] Bouchette, *British Dominions*, 1:369; Rochester, N. Y., *Daily Advertiser*, quoted in Montreal *Canadian Courant*, Dec. 24, 1833.

[25] *Neilson's Quebec Gazette*, quoted in *Canadian Courant*, Nov. 23, 1833.

[26] The midge is not to be confused with the Hessian fly, which did much damage in the seigneuries between 1805 and 1816, and did not pass away completely till after 1830.—H. Y. Hind, *Essay on the Insects and Diseases Injurious to the Wheat Crops*, 42–43 (Toronto, 1857).

[27] *Ibid.*, 77–78; Montreal *La Minerve*, quoted in Hallowell, Upper Canada, *Free Press*, July 30, 1833; Henry Taylor, *Journal of a Tour Thro' Berthier and Sorel to the Eastern Townships*, 5, 23, 27 (Quebec, 1840). The failure of the wheat crop in the Montreal region and the Richelieu Valley undoubtedly had much to do with the unreasoning discontent which prevailed in Lower Canada in the middle thirties. As it was where the midge was worst that the risings of 1837–1838 took place, something might be made of the contention that it was not without responsibility for them. Cf. the remark in H. A. Innis and A. R. M. Lower, *Select Documents in Canadian Economic History, 1783–1885* (Toronto, 1933): "The editor hazards the suggestion that the Lower Canada crop failure of 1835 was not without its bearing on the political agitation of these years."—p. 256.

resorted to in an effort to check the plague, from sowing lime or a mixture of Scotch snuff and wood ashes broadcast on the standing grain when the dew was heavy to holding religious meetings and processions,[28] but all to no purpose. Apparently nothing could be done to overcome the midge.

As early as 1838, many of the British farmers in the Montreal district were ceasing to grow wheat,[29] but their distress was not to be compared with that which overtook the habitants of the seigneuries. Among them, men who once had wheat to sell in large quantities now had to buy flour for their own use. In 1829, crop shortages in Yamaska in the heart of the Richelieu Valley resulted in the importation from New York of 4,000 barrels of flour of different kinds, an incident which presented "the novel occurrence of the Inland parishes of Lower Canada being fed by supplies received seaward, from the United States."[30] In 1835, when the wheat crop in Lower Canada was almost a complete failure, and the Upper Canada surplus was marketed in the United States, nearly 500,000 bushels of wheat had to be imported from Europe to feed the population of the province.[31] This importation of breadstuffs for home use continued down to mid-century,[32] though, after 1836, always from the western interior.

Evans, an excellent authority, in 1849 estimated the damage already done by the midge alone in Lower Canada as fully £6,000,000 currency, or about $24,000,000.[33] Added to the problem of the midge was that of wheat rust, which in certain seasons was equally destructive.[34] As a result of the annual devastation by one enemy or the other it was quite clear in the early forties that the habitants had been driven out of wheat, with consequences depicted by Evans in these words: "The loss of wheat to the farmer is most severely felt. It has been the cause of deranging the whole system of agriculture. A large proportion of the arable land of every farm might have been appropriated to the growing of wheat, but since the failure of that crop, all the land is employed in producing crops that can only be consumed in Canada. Hence, the market must be glutted with this description of produce."[35]

Evans here touched on one effect of the failure of wheat—the turning more and more to coarse grains such as oats, peas, and barley.[36] Unfortunately, there was little demand for barley or rye, except at the breweries and dis-

[28] Hind, *Essay*, 95-101; Patrick Shirreff, *Tour through North America, Together with a Comprehensive View of the Canadas and the United States as Adapted for Agricultural Emigration*, 136 (Edinburgh, 1835); *Canadian Agriculturist* (Toronto), August 1859, p. 180.

[29] *Canadian Quarterly Agricultural and Industrial Magazine*, 1:71 (Montreal, 1838).

[30] Quebec *Mercury*, quoted in Kingston, U. C., *Gazette*, June 5, 1829.

[31] Montreal *Morning Courier*, Dec. 31, 1836.

[32] *British American Cultivator* (Toronto), February 1843, p. 20; *Journal d'Agriculture*, septembre 1849, p. 257.

[33] *Ibid.*, février 1849, p. 33.

[34] *British American Cultivator*, October 1842, p. 148; *Canadian Agricultural Journal* (Montreal), Oct. 1, 1844, p. 154.

[35] *British American Cultivator*, August 1842, p. 117.

[36] J. F. W. Johnston, *Notes on North America: Agricultural, Economical and Social*, 1:363 (London, 1851).

tilleries of Montreal and Quebec. Oats could be sold to advantage only to the liveries, draymen, and garrisons of the towns, or at the shanties of the lumbermen operating in the Ottawa Valley or towards the Maine frontier.[37] None of these coarse grains would stand the cost of transportation overseas. Under these circumstances, the habitants found little profit in producing them for sale, though some drove into Montreal from distances as great as a hundred miles with loads of oats and barley.[38] The consequence was that the only place most of them could be disposed of was on the farm, if not in oaten or barley bread or in pea soup, then in livestock feed; but, for reasons to be pointed out shortly, livestock raising was not an enterprise on which the habitants could embark with confidence.

At the time the habitants were finding that growing coarse grains for market was not the answer to their problem, they suffered a calamity which was scarcely less devastating than the failure of wheat. In their endeavor to find a substitute for the wheat flour which they would have to purchase, they began to depend in large part on potatoes for food. Then, in 1843, the potato crop in Lower Canada, as throughout North America in general, was attacked by the "late blight" or "rot." The disease was exceptionally bad in 1844, 1845, and 1846, and by the end of 1847, the crop had to be given up in large sections of Lower Canada.[39] As an acute observer remarked, "in this state of things, when by the previous failure of the wheat, the potato had become doubly precious, it will be understood how the potato disease must have produced a more intense amount of suffering among the Lower Canadians."[40]

In many parts of North America, farmers who have been driven out of wheat growing have turned to livestock husbandry. Eventually, the habitants did find some salvation in this branch of farming, but this was not till after 1850. The delay is to be explained as follows.

The habitants had long raised livestock as part of their general farming. They kept the different animals common in the New World, with this distinction—theirs as a rule were smaller, but hardier, than those kept elsewhere. Their "landshark"-type pigs were inferior even to those of Vermont, but the habitants liked them, because, pea fed, they produced excessively fat pork.[41] Their sheep somewhat resembled Merinos in size, but they had such coarse wool and so little of it, that they were of no commercial significance.[42] Their cattle belonged to a small breed, black or red, closely related to the Jerseys.

[37] Cf. *Report from the Select Committee on the Timber Duties, No. 113*, p. 147 (London, 1836).

[38] *Journal d'Agriculture*, janvier 1850, p. 18.

[39] *Journal and Transactions of the Board of Agriculture of Upper Canada for 1855–6*, p. 39 (Toronto, 1856); *Canadian Agricultural Journal*, Oct. 1, 1844, p. 154; Oct. 1, 1845, p. 46; *Journal d'Agriculture*, avril 1848, p. 110.

[40] Johnston, *Notes on North America*, 1:363.

[41] Lambert, *Travels*, 1:75, 143; Evans, *Treatise*, 187.

[42] Bouchette, *British Dominions*, 1, "Beauharnois"; Ezra Carman, E. A. Heath, and John Minto, *Special Report on the History and Present Condition of the Sheep Industry in the United States*, 343–346 (Washington, 1892).

So inferior was their beef considered that the butchers of Montreal and Quebec raised their own cattle to some extent, instead of buying from the habitants, and the government contractors obtained from Vermont most of what they supplied to the Lower Canada garrisons.[43] Furthermore, although their milk was good, these cattle were not ordinarily used for commercial dairying. In fact, the only cheese manufactured by the habitants was of a kind ungraciously called "stinking cheese," and little of this, or of any other Lower-Canadian kind for that matter, reached the market; and only one region, Kamouraska, developed a reputation for butter.[44]

The best animals the habitants had were their horses. They fitted in so well with wheat growing that the habitants had always raised a greater proportion of them than of any other kind of livestock; too many perhaps, for the good of their farms.[45] Though, except in Kamouraska, French-Canadian horses were so small as to be referred to by Europeans as "ponies," they were strong and well-proportioned.[46] On account of these desirable qualities, they had been exported through Connecticut or New York to the West Indies even before the American Revolution. Nor was the trade less active thereafter. In the first half of the nineteenth century, American dealers, as well as some from Upper Canada, were accustomed to visit Montreal and other places in Lower Canada to purchase the best of the French-Canadian horses, bringing with them in trade larger but inferior ones.[47]

The habitants liked to have the "Yankee horse-jockeys" buy their colts, for the income thus provided was often all they had, aside from that brought in by their wheat. And yet the emphasis on horse raising which was thus encouraged was possibly unfortunate, for the horses were pampered, relatively, at the expense of the rest of the livestock. The habitants were notorious for the defective manner in which they fed and sheltered their cattle, sheep, and pigs. Their pastures were deficient, except for a few valuable ones along the river fronts, and even these were probably entirely composed of wild grasses.[48] Ordinarily,

[43] Lambert, *Travels*, 1:82, 142; evidence of Philemon Wright, *Journal of the Legislative Assembly of Lower Canada, 1824*, App. TT.

[44] Lambert, *Travels*, 1:86, 106; Laterrière, *Political and Historical Account of Lower Canada*, 128.

[45] Thus, Kalm wrote in the middle of the eighteenth century: "It is a general complaint that the country people begin to keep too many horses, by which means the cows are kept short of food in winter." Peter Kalm, *Travels into North America . . .* (ed. 2, 1772), as translated in John Pinkerton, *General Collection of the Best and Most Interesting Voyages and Travels in all Parts of the World*, 662 (London, 1812).

[46] Campbell, *Travels*, 1:114; Lambert, *Travels*, 1:142.

[47] P. W. Bidwell and J. I. Falconer, *History of Agriculture in the Northern United States 1620–1860*, p. 113 (Washington, 1925); Lambert, *Travels*, 1:143–144; Evans, *Treatise*, 119; *Canadian Agricultural Journal*, March 1845, p. 43. So extensive was this trade into the United States that by 1845 there was a noticeable infusion of the blood of the French-Canadian horse in Vermont.—*Cultivator* (Albany, N. Y.), August 1845, p. 256.

[48] George Heriot, *Travels through the Canadas*, 58 (London, 1807); Lucas, *Lord Durham's Report*, 2:97.

animals nourished themselves as best they might on the weeds of the idle arable land previously referred to, or on the waste or woodland portions of the farm. When winter came, many of them were butchered, to avoid the labor and expense of keeping them over till the next year, as well as to make it possible to feed the horses all the forage cut during the summer.[49] In no respect was there a greater difference between the habitants and the British farmers in Lower Canada than in the care they took of their livestock.[50]

With this heritage, habitants who desired to engage in cattle, hog, or sheep raising were handicapped from the start. Moreover, livestock raising required capital, which, owing to the failure of wheat, they lacked. To be profitable, it also required some assurance of a market, and this too they did not have.

Before 1843, the habitants could not hope to produce butter, cheese, or meat for export overseas, as the British duty was prohibitive;[51] nor did they have a home market for such articles. After 1815, Montreal and Quebec were great exporters of the agricultural surplus of the basin of the Great Lakes. The consequence was that the foodstuffs they consumed were more easily obtained from the westward than from any but the most adjacent parts of Lower Canada. Thus, the lumber shanties of the Ottawa Valley came to be supplied through Montreal with Cincinnati pork, the butchers of Montreal and Quebec with Vermont cattle, and the grocers of the towns of Lower Canada with Ohio or Vermont cheese.[52] The British farmers around Montreal did get a share of the local livestock market, and so did the inhabitants of the Eastern Townships,[53] but both of these groups found difficulty in competing with American imports. They therefore campaigned persistently, like their fellows in Upper Canada, for an agricultural tariff, which they finally achieved in 1843.[54] Nevertheless, even after this act went into operation, complaints continued to be made that the Lower Canada markets were glutted with American produce.[55] Under these circumstances, when the relatively efficient British farmers of Lower Canada could not meet American competition, it would have been unreasonable to expect any appreciable growth in livestock raising among the habitants; and none took place.

Nothing the habitants could do, seemingly, promised economic salvation. By mid-century their situation had become one of chronic distress. Clergy, businessmen, newspaper editors, and politicians continually discussed it. They agreed in their analyses of the more obvious defects of agriculture in the St. Lawrence Valley—lack of fertilizing, lack of proper rotation, lack of approved

[49] Weld, *Travels*, 1:395.

[50] Bouchette, *British Dominions*, 1, "Beauharnois."

[51] *Canadian Agricultural Journal*, January 1, 1844, p. 8.

[52] Evans, *Treatise*, 43, 116–117, 133; *British American Cultivator*, May 1842, p. 80; February 1843, p. 20; R. L. Jones, "The Canadian Agricultural Tariff of 1843," *Canadian Journal of Economics and Political Science*, 7:532–533 (Toronto, 1941).

[53] Taylor, *Journal*, 39.

[54] Cf. Jones, "The Canadian Agricultural Tariff of 1843," p. 534–535.

[55] *Journal d'Agriculture*, juillet 1848, p. 214.

stock-raising methods, lack of improved implements, too much concentration on wheat—but they showed much difference of opinion when they tried to account for these defects.

Some believed that the seigneurial or feudal system of land tenure was responsible for the bad agriculture of the French-Canadians. Thus, Lord Durham pointed out that the British purchaser of a seigneury found that the tenure made it difficult for him to improve his land, because, so long as the habitant paid his rent, he could not be removed, nor forced to adopt more advanced farming methods. Moreover, Durham claimed that the French tenure was unpopular even with the habitant.[56] However, it did have certain advantages for the latter, particularly in the pioneering period, for it enabled him to use his limited capital entirely in equipping his holding, instead of in purchasing land. It sometimes happened, therefore, that the habitant settled in an undesirable location in the seigneuries in preference to going into the adjacent Eastern Townships.[57] On the whole, it seems that, though the seigneurial tenure had outlived its usefulness, it was not the prime cause of the bad agriculture of the French-Canadians. The best informed students of Lower-Canadian farming, such as William Evans, seldom accorded it more than passing mention.

Others believed that the root of the problem lay in overpopulation of the seigneuries, with the consequent emigration of the French-Canadians to the United States, and this opinion has been repeated with much emphasis in a recent book.[58] It is true that, in some of the seigneuries, the land had become so excessively subdivided in the course of generations that it was unable to support all its inhabitants by farming, and the young men accordingly often went off to work in the fisheries of the Gulf, in the harvest fields of Upper Canada, in the timber industry of the Ottawa, or, after about 1840, in the factories of New England.[59] Probably this exodus would have been regarded as no more than normal, if it had occurred among any other group than the French-Canadians. In any case, no matter how much overpopulation may have aggravated the rural distress of the seigneuries, it does not seem to have been the fundamental reason for the defects in agriculture prevailing in them.

Other critics, with more insight, ascribed the bad farming of the French-Canadians to the lack of markets. In one sense it could be maintained that the habitants really had no cause for complaint in this regard; as the Select Committee on Lower Canada Agriculture pointed out in 1850, they were much more favorably situated with respect to a market than the farmers near Lake

[56] Lucas, *Lord Durham's Report*, 2:24–25, 28, 36, 263.

[57] Laterrière, *Political and Historical Account of Lower Canada*, 168–169, 179–180. On the advantages of the seigneurial system, cf. A. L. Burt, "The Frontier in the History of New France," Canadian Historical Association, *Report*, 1940, p. 94–95.

[58] Marcus L. Hansen and J. B. Brebner, *The Mingling of the Canadian and American Peoples*, 124–125 (New Haven, Toronto and London, 1940).

[59] *Journal of the Legislative Assembly of Canada, 1849*, App. PPPPP; *Journal d'Agriculture*, juillet 1850, p. 196–197.

Erie or Lake Huron or Lake Michigan.[60] Of course, this was true only of wheat, which the habitants could not grow; as already indicated, unless they were very near Montreal or Quebec, they could not sell profitably the other products to which they had been forced to turn, owing to the ease with which similar articles could be brought in from outside. The habitants were among the first in the East to suffer from effective western competition; and their agriculture reflected this fact.

Still others who gave thought to the subject felt that the backwardness of the seigneuries was to be attributed, in part at least, to the lack of formal instruction in the theory and practice of agriculture. Carrying this idea to an extreme, a writer recently has claimed that if the British Government had provided such a program, even of the most elementary kind, it would have aroused a spirit of curiosity and emulation "to which the most refractory peasant would not have remained indifferent."[61] This assertion completely disregards the fact that when the British in Lower Canada tried to change the old ways, officially or privately, they were rebuffed, or were met with indifference. The resistance to changes in the seigneurial system is one example. Another might be found in the attempt to eliminate the nuisance of the cahots, or pitchholes, which made the winter roads in the seigneuries worse than any other roads in North America where snow fell.[62] Lord Sydenham in 1841 issued a special ordinance in the hope of eliminating the cahots, but it could not be enforced against the will of the habitants, and so, at least as late as the early 1860s, the nuisance still flourished everywhere in French Canada, except in the immediate vicinity of Montreal.[63] Still another example might be found in the unhappy history of the Lower-Canadian agricultural societies. The British farmers who promoted these societies and their exhibitions tried to interest the French-Canadians. They met with scant success, for in the societies where the French and British farmers competed on a basis of equality, the British won all the prizes, because they had superior farming knowledge, and the habitants soon withdrew in discouragement; in the other societies, which had separate classes for the British and French exhibitors, the directors found they were giving prizes to the habitants for rubbish.[64] Finally, the habitants failed to benefit even from observing the practices of the British farmers who were settled in

[60] *Journal of the Legislative Assembly of Canada, 1850*, App. TT.

[61] Gérard Parizeau, "Aperçu de la situation économique dans le Bas-Canada vers 1837," in Canadian Historical Association, *Report*, 1937, p. 57.

[62] The habitant did not attach the shaft to the sleigh rigidly, but by means of a chain. Thus, when the tension slackened, the shaft piled up the snow in little heaps; when it tightened, the runners went over the heaps, packing them down; and so was created a succession of cahots. Cahots were not produced when the shaft was rigidly attached, as was the practice in Upper Canada and the Eastern Townships.

[63] Evans, *Treatise*, 146-147; Hind, *Eighty Years' Progress*, 105-107; Montreal (biweekly) *Witness*, Mar. 15, 1862.

[64] *Canadian Courant*, Feb. 27, Mar. 6, 1833; letter of William Boa of St. Laurent, July 12, 1850, in *Journal of the Legislative Assembly of Canada, 1850*, App. TT.

their midst.[65] Under these circumstances, the hopelessness of any program of governmental agricultural education which might have been undertaken is understandable.

One other reason for the backwardness of French-Canadian agriculture was commonly given—the ingrained conservatism of the habitants. Few in Lower Canada, among the British at least, would have quarrelled with Lord Durham's assertion that the French-Canadians "clung to ancient prejudices, ancient customs and ancient laws, not from any strong sense of their beneficial effects, but with the unreasoning tenacity of an uneducated and unprogressive people."[66] He was right, for the habitants, it must be remembered, had been cut off from association with France since the British conquest, and under the leadership of their clergy they had since developed a spirit of French-Canadian nationalism. Aside from the notaries, the parish priests, and a few others regarded as their leaders, they were illiterate.[67] Dedicated as they were to the preservation of their laws, their language, and their religion, they resisted any change, however small, in their mode of life. It was this aversion to innovation which rendered the distress in the seigneuries so acute, and made it so difficult to ameliorate. When we add to the persistence in eighteenth-century, frontier-farming methods the fact of effective western competition, we find it difficult to conceive of a more discouraging outlook than that which confronted the agriculturists of the St. Lawrence Valley in 1849.

Conservatism in agricultural methods was characteristic of the habitants for another generation,[68] but fortunately its effects were less disastrous after about 1850. The change was to be ascribed only in part to the termination in 1854 of the seigneurial system, and to the operation, beginning in 1848, of various plans of church-directed "colonization," that is, the removal of the redundant French-Canadian population to new parishes.[69] Fundamentally, it was brought about by the sudden opening in the summer of 1849 of a market in the United States, not only for more horses than ever before, but also for precisely those commodities in which the habitants had hitherto found no profit—oats, barley, poultry, eggs, and butter.[70] The involved story of the origin and development of this trade we hope to deal with in another article. We therefore pass over it for the present, merely stating that the exports across the border continued to grow in importance till the Reciprocity Treaty expired in 1866. The opening of the American market affected the whole province of Canada, but nowhere was it more welcomed than in the St. Lawrence seigneuries, where, after their long succession of disappointments, the habitants now enjoyed a relative prosperity.

[65] *Journal d'Agriculture*, février 1850, p. 30; mai 1850, p. 133.
[66] Lucas, *Lord Durham's* Report, 2:30.
[67] Cf. Durham's strictures on French-Canadian education in *ibid.*, 30-34.
[68] G. M. Grant, *Picturesque Canada; the Country as it Was and Is*, 1:84 (Toronto, 1882).
[69] On the subject of "colonization," cf. Lower, *Settlement and the Forest Frontier*.
[70] *Journal d'Agriculture*, novembre 1849, p. 338-339, and later numbers.

PEHR KALM'S OBSERVATIONS ON BLACK WALNUT AND BUTTERNUT TREES

ESTHER LOUISE LARSEN

Library of Congress

The writings of Pehr Kalm, the famous Swedish botanist, are among the most important sources of historical data on mid-eighteenth century America. Historical students are generally familiar with his famous journal, *En Resa til Norra America* (Stockholm, 1753–1761), which has been translated and variously published in Dutch, English, French, and German, but his articles on American subjects which were printed in the Kongl. Svenska Vetenskaps Academiens *Handlingar* for 1749 to 1778 are also important, especially for the scientific observations which they contain, and have deserved translation and scholarly attention.[1]

The article which is translated below under the heading, "The Characteristics and Uses of the North American Black Walnut Tree" appeared with the title, "Norr-Americanska svarta Valnöt-trädets egenskaper och nytta," in the Kongl. Vetenskaps Academiens *Handlingar*, 28: 51–64 (1767). The translation under the heading, "The Characteristics and Uses of the White Walnut Tree" bears the title, "Om Hvita Valnötträdets egenskaper och nytta," in the *Handlingar*, 30: 119–127 (1769). The translator is indebted to Mrs. Helen K. Zirkle, Mr. R. Kent Beattie, and Mr. John B. Dale for advice and assistance.

THE CHARACTERISTICS AND USES OF THE NORTH AMERICAN BLACK WALNUT TREE[2]

Several persons, foreigners in particular, have from time to time asked me in writing what I had occasion to learn concerning the characteristics and uses of American trees

[1] The articles in this series which have already been translated and published by the present translator are as follows: "Lobelia såsom en säker läkedom emot Veneriska sjukan," from the Kongl. Vetenskaps Academiens *Handlingar*, 11:280–290 (1750), under the title "Lobelia as a Sure Cure for Venereal Disease," in the *American Journal of Syphilis, Gonorrhea, and Venereal Diseases*, 24(1):13–22 (January 1940); "Beskrifning Huru Socker göres uti Norra America at åtskilliga slags trän," from the *Handlingar*, 12:143–159 (1751), under the title, "Peter Kalm's Description of How Sugar is made from Various Types of Trees in North America," in *Agricultural History*, 13:149–156 (July 1939); and "Beskrifning om Mays, Huru den planteras och skötes i Norra America, samt om denna Sådes-artens mångfaldiga nytta," from the *Handlingar*, 12:305–318 (1751), 13:24–43 (1752), under the title, "Pehr Kalm's Description of Maize, How It is Planted and Cultivated in North America, together with the Many Uses of This Crop Plant," in *Agricultural History*, 9:98–117 (April 1935). Kalm's octavo pamphlet (Stockholm, 1751) with the heading, "En Kårt Berättelse, om Naturliga stället nyttan, samt skötseln af några wäxter, utaf hwilka frön nyligen blifwit hembragte från Norra America, til deras tjenst, som hafwa nöje, at i wårt Climat göra försok med de sammas cultiverande" has also been translated and printed under the title "Peter Kalm's Short Account of the Natural Position, Use, and Care of Some Plants, of which the Seeds were Recently Brought Home from North America for the Service of those who Take Pleasure in Experimenting with the Cultivation of the Same in Our Climate" in *Agricultural History*, 13:33–64 (January 1939).

[2] *Juglans nigra.*

and vegetables. I usually answer these questions through the press. In Europe, those who have gone to the trouble to care for these plants in their gardens will be encouraged to continue after they learn what uses the inhabitants make of them in localities where they grow wild. When travelers return and see these trees and plants, which were mentioned in descriptions of travel or other books, they consider themselves fortunate to read such writings, particularly if they themselves also are familiar with the many benefits that can be derived from the products of the plant kingdom.

In order to comply with demand, I now have the honor to make a beginning with the American walnut trees. There are several kinds. I will first dispose of the so-called black walnut. Since I am discussing the walnut tree, I think, God willing, I will pass by that which concerns the uses, pecularities, and characteristics of other American trees and plants. Botanical accounts of these trees I omit. They would take too much room. Besides, a great number of these American plants have already been accurately described in various botanical books, but their uses are very rarely given. Not many have had such a good opportunity as I to make investigations while traveling around in America. When I furnish the names given these plants by Archiater and Knight von Linné, it should be possible for each and every one who knows anything about herbs to distinguish them from all other plants.

Name: Juglans (*nigra*) foliolis quindenis lanceolatis serratis, exterioribus minoribus, gemmulis super axillaribus. Linn[aeus], *Spec*[*ies*] *Plant*[*arum*], 1415 [ed. 2, 1763].

Juglans (*nigra*) foliolis lanceolatis argute serratis, exterioribus minoribus. Linn[aeus], *Sp*[*ecies*] *Pl*[*antarum*], 997 [ed. 1, 1753]; *Hort*[*us*] *Cliff*[*ortianus*], 449 [1737]; *Hort*[*us*] *Ups*[*aliensis*], 287 [1748]; *Gron*[*ovius*], *Flor*[*a*] *Virg*[*inica*], 189 [1762].

Nux Juglans virginiana nigra. [Paulo] Herm[anno, *Horti Academici*] *Lugdb*[*uno-Botevi Catalogus*], 452. t. 453. [1687]; [Mark] Catesb[y, *Natural History of*] *Carol*[*ina*], 1:67 t. 67.

It is called *black walnut* or *black walnut-tree* by the English living in America. The Swedes living there call it *Svart Nötbom* and occasionally *Svart Valnöt-träd.* It has received this name because of the dark brown color within the tree itself; in contrast, the other trees found in North America generally have white wood.

Habitat: It grows wild all over Pennsylvania and even in most parts of New Jersey. It is common in Maryland, Virginia, and Carolina, as well as in those places which lie further inland in the same latitude. Just north of New York, it becomes very rare. The farthest north I saw it growing wild was about 41 degrees and 30 minutes north latitude.

I saw that the inhabitants had planted this tree on estates in many places still farther north between New York and Albany. Nuts procured from New Jersey and from the southern part of the province of New York had produced an abundance of trees which were doing quite well. The inhabitants hoped that they would seed themselves in the future.

The habitat which the black walnut particularly prefers is a small elevated place in rich, fat, black earth. It does very well in similar soil on river banks; it does not do so well at the seashore.

Flowering time: In Pennsylvania it began to bloom on May 7, 1749 new style (all dates to which I refer following this one are to be interpreted as new style). The following year, 1750, the European walnut tree (*Juglans regia*) which had been planted in Pennsylvania and New Jersey had already finished blooming by May 5. The black walnut tree had just begun to bloom.

Leaves come out rather late. The leaves came out about the ninth of May, 1749, and about the same time the following year.

Nuts ripen quite late, namely, about the end of September in Pennsylvania and New Jersey. In the year 1749, nearly all the nuts had fallen by October 18. The following year, nearly all the nuts had dropped from the black walnut trees by October 6.

Leaves fall as soon as the nuts are ripe, provided the weather is not unusual. Nearly all the trees had lost their leaves by the 18th of October, 1749. The following year, 1750, the trees were not entirely bare until October 28.

Characteristics: Although the usefulness of this tree will be discussed shortly, in this locality it appears to be more injurious to fields, meadows, orchards, and gardens than any other tree. It has the bad habit of choking out and killing all kinds of trees and plants which grow near it, such as apple, cherry, grain, flax, and vegetables. That which is seeded near this tree can not thrive but dies by degrees. Various Swedes assured me that they had lost several apple trees merely because they were growing near black walnut trees. One declared he had lost over 40 apple trees, because he had let several black walnuts remain on the place where he had set out an apple orchard. It is impossible to get apple trees to grow in the neighborhood of black walnuts, but as soon as they are cut away, the growth of the apple trees more than satisfies expectations. The real cause of this is unknown. The most prevalent belief is that the dew and vapor which blow from these trees to others nearby kill them in some way; for, when the leaves are crushed between the fingers, they produce a strong unpleasant odor. This may well be the case, but the chief reason seems to be that the roots of the tree spread great distances on all sides, absorbing all moisture and nourishment from the soil. This idea was strengthened by my own observations. Mr. Lewis Evans, an engineer, had a black walnut tree in a large vegetable garden outside of Philadelphia. In the vegetable garden nothing came up which was planted near the tree, therefore, the tree was cut down and all the roots dug up. It was then discovered that the main trunk produced a number of large roots; two or three went straight down, but all the others lay horizontally, spreading under most of the vegetable garden, just a foot below the soil. Although the tree stood close to the wall which separated Evans' garden from that of his neighbor and shaded both gardens equally, the neighbor's garden, which was planted near the tree, grew fairly well. It was discovered that although the tree stood close to the wall, very few roots grew under the neighbor's garden and nearly all the roots were under the Evans garden.

No matter what size roots are found, they are not usually brown all the way through like the tree itself. The center of the root is white; only two to three fingers' breadth being brown. However, the top of the root, or that part which lies near the surface, is brown all the way through. When white roots are taken up and exposed to the light, they also become brown but not as dark as the wood of the tree itself.

If dew or rain drips from this tree on to linen clothing it becomes spotted.

In this country there is scarcely any tree which flourishes as well as this one and produces such large annual rings. It is rather peculiar that fine grains of sand are often found in the veins and pores of the thickest trees. Because of this, drawknives and other sharp tools used on black walnut soon become blunt and worthless, and must be sharpened frequently. However, trees are found in which no sand is noticed. The presence or absence of sand in the wood may possibly be due to the type of soil in which the tree grows.

I was assured that this tree is never affected by the cold, although the winters in Pennsylvania and New Jersey are sometimes so cold that pears, young hickory, and occasionally mulberry trees are injured.

When a tree is eight to ten years old, it begins to bear nuts. The older it gets, the more nuts it produces, until it begins to decline because of age or other contingencies.

Trees in open fields, where their branches can spread, produce more, larger, and better flavored nuts than those which grow in dense forests. These trees do not produce the same amount of nuts each year. The black walnut trees were quite productive in the year of 1748. In contrast, in the year of 1749, black walnuts, hickory nuts, chestnuts, and all kinds of acorns were scarce, although field crops grew well and apple trees bore plentifully. In the autumn of 1750, acorns and the nuts mentioned above were so plentiful that in many places the ground under the trees was covered with them to the depth of a foot or more. The greatest quantity remained on the ground, for no one succeeded in collecting and taking care of all of them. The apples were scarce that year, but the pears were plentiful all three years.

Age and rate of growth. The rapid growth of this tree is illustrated by one I saw in New Jersey, which was about 44 years old. It was 9 *famnar* high and the trunk was 3½ *alnar* in thickness one *aln* from the ground.[3]

Insects. Although the leaves are not eaten by cattle and beasts, because of their rather strong unpleasant smell and taste, I noticed in the spring of 1750, that most of the leaves of the trees in Pennsylvania and New Jersey were so completely eaten up by a type of worm (which is described in K[ongl.] Vet[enskaps] Academiens *Handlingar* [25:]124 [139] 1764) that soon they were completely naked. The worms even ate the leaves of the black walnut, but they were not as tempting to them as the leaves of oaks and certain other trees.

Uses. The heart of the tree is brown, mixed with darker or lighter veins and spots, and articles made from it are very good looking. The wood of the thick roots, which shifts in color from darker to lighter veins and spots, is still better looking. In its natural state it has the appearance of wood which has been carefully and skillfully finished by us. Therefore, cabinet makers usually place the piece taken from the root on that side of the cupboard, bureau, desk, etc., which shows. Occasionally whole trees or large branches are found, having through their entire length and breadth, a beautiful brown color and having throughout a quantity of black spots which look rather pretty.

Because of its pleasing color, the black walnut tree is quite highly valued in North America by carpenters and joiners. They prefer this tree not only to the English walnut but also to nearly all native trees with the exception of the wild cherry (*Prunus virginiana*).[4] The black walnut often competes for first place with mahogany, an expensive tree which comes from the West Indies or the American islands lying near the equinoctial meridian. Black walnut is used in all fine cabinet work such as bureaus, desks, cupboards, tables, chairs, chests, boxes, clock cases, candlesticks, cradles, gunstocks, pulpits, altar rails for churches, and coffins. The color and mottled graining are excellent and become more beautiful with age. For this reason it was the most expensive of all native North American trees with the exception of the wild cherry. This wood is just as expensive and occasionally even more so. In the spring of 1751, carpenters in Philadelphia paid from 14 to 20 shillings, Pennsylvania mint, for 100 feet of black walnut and from 14 to 22 shillings for the same amount of wild cherry. A bureau made from black walnut mounted with locks, brass handles, and all accessories, cost 7, 8, 9, or 10 pounds, Pennsylvania mint (our pound at that time was valued at about 5 *plätor*), in Philadelphia, although 8 to 9 pounds was the most usual price.

Of all the trees growing wild in that country, there is none which retains its color so

[3] A *famn* equals the compass of the arms or about six feet. An *aln* is 24 to 36 inches. The "3½" may be a typographical error as a tree of this height is about 2 feet in diameter.

[4] Kalm undoubtedly meant *Prunus serotina* Ehrl., the wild black cherry.

well as the black walnut. The older anything made from it becomes, the better it looks. In order to improve the color and add luster, furniture made from it is polished and waxed in the usual manner.

Each year a large quantity of walnut boards and planks are shipped to Europe, where they are sold at a good price. This is largely the reason black walnut is much more expensive than it used to be. Several carpenters informed me that in 10 years' time it had doubled in price. Colonizing is undoubtedly another factor which has brought about high prices; for, when wood is needed, this tree is pulled up like all others. Several times I visited places where black walnut was the only wood used in the fireplace.

The nuts are round as balls, larger than the European nuts, and much harder; therefore, it is necessary to use a hammer or something hard to break the shells before the kernels can be taken out. The kernels are more completely enveloped in the hard shell than they are in the European walnut. In flavor they are almost as good as the one just named. They are, therefore, eaten with great relish.

Before Europeans came to America, the Indians who had no cattle knew very little about milk. They furnished themselves with a kind of milk in this manner: The nuts of the black walnut and hickory (a kind of walnut tree which will be discussed at another time, God willing) are collected, dried, and broken to pieces. The kernels are removed and ground into flour, which is mixed with water and used for food and drink. Due to its sweet and pleasant flavor it resembles milk. The Indians still make use of this walnut milk.

An oil, which is said to be marvelous for treating sore chests, is pressed from the kernels.

Both the gray squirrels and ground squirrels collect these nuts and store them in their caches for winter food.

A brown dye, which does not fade, is obtained from the bark of the tree and from the moist black husk which surrounds the nut.

The husk, when fresh, stains the hands so heavily that it takes two to three weeks to remove the stain completely.

The black walnut is usually planted in all yards, not only for the nuts, but also because of the tree, which is beautiful with its spreading branches and large leaves. It is usually planted close to the milkhouse, because the large, leafy branches always produce shade for the aforesaid house. Since springs are plentiful in this country, special care is taken to have a spring near the yard where a house is to be built. A small, stone house is built over the spring, and one to several black walnuts or water beech (*Platanus occidentalis*) are planted on two sides, but particularly on the sunny side. They grow fast and send out several large leafy branches, which form a dense shade over the milkhouse. This shade, plus the cold spring water, makes the air of the milkhouse cool. Jars and other vessels into which the milk has been strained are set in the running water of the spring to chill. These milkhouses are briefly described in [*En*] *Res* [*a til Norra*] *Amer*[*ica*], 2:223 [1753, 1761].

Walnuts which are to be used for planting in North America are allowed to stay on the trees until they fall. Then they are usually dead ripe. They are generally planted in the autumn. If it is desirable to keep them until spring, they can be stored in the dry sand, in a fairly cool room. This procedure will prevent them from becoming rancid and from losing their power to germinate. In Pennsylvania and New Jersey experience has shown that it is best to plant the nut exactly where the tree is to stand. If they are planted in a seedbed or elsewhere and later moved, and if the following winter is unusually

cool, the greater number will die. Those which are not transplanted live through the winter without the slightest injury.

The black walnut trees which I raised from nuts here in Finland were planted in part in my orchard in Staden and in part at plantations in Sipsalo. The former were quite delicate, because the lowland type of soil was not suitable. Those planted in Sipsalo on high places in good, rich soil were not injured during severe weather. Although the winter of 1760 was so unusually cold that it killed some of our wild trees, the black walnuts in Sipsalo were not in the least affected. I have also mentioned this in Kongl. Vetenskaps Acad[emiens] *Handling[ar]*, 1761, on pages 19, and 129–130. Although these trees have reached a height of 5 *alnar*, they have not yet begun to bear fruit.

There may be some question as to the advisability of planting the tree in this country. It is evident from the foregoing that the black walnut tree, which is native to America, where the summers are so long and hot, always takes considerable time before its nuts ripen completely. Our summers are not nearly so long and hot as the American summers. There is, therefore, little hope that they can ever produce ripe nuts in this country. Here is the answer: Since they stand our climate fairly well if they are planted in proper places, it would be worth while, in view of the trees' appearance and value as lumber, to obtain nuts from North America, if necessary, in order to plant them here. Several foreign plants, and even North American plants, have demonstrated that they can adapt themselves by degrees to our climate. Therefore, we have every reason to hope the same will be true of this tree.

THE CHARACTERISTICS AND USES OF THE WHITE WALNUT TREE[5]

Name. By those who describe plants, this tree, in addition to others, has received the following names:

Juglans foliolis septenis lanceolatis serratis, impari sessili. Linn[aeus], *Spec[ies] Plant[arum]*, 1415 [ed. 2, 1763].

Juglans alba, fructu ovato compresso, profunde insculpto durissimo: cavitate intus minima, plerumque apyrena; anglice *White Walnuts*. Gron[ovius], *Flor[a] Virg[inica]*, 190 [1762].

The English in North America generally call it white walnut, that is *Hvitt Valnöt-träd*, because the tree is entirely white throughout, and not brown or blackish like the black walnut tree. A discussion of the latter can be found in [Kongl.] Vet[enskaps] Acad[emiens] *Handl[ingar]* for the year 1767 on page 51 and those following. Some of the English living in the vicinity of Albany call it butternut or *Butternuttree*, that is *Smör-nötter* and *Smörnöt-träd* and some of them *Oyly-nut* or *Oyly-nuttree*, that is *Olje-nötter* or *Olje-nötträd*. The nuts seem to be covered with butter or oil. If they are still green when gathered, the collector's hands become smeared with butter. The French in Canada call them *Noyers longues*, because the nuts are oblong and longer than those on any other walnut tree. The Dutch living in the Province of New York call them *Olje Noot-Boom*.

Habitat. The white walnut is quite common in North America both in the English colonies and Canada. However, it is not so common in Pennsylvania as other species of walnut trees, namely, the black walnut tree and several kinds of the so-called hickory. (At another time, God willing, I will describe the last named.) In many places between New York and Albany, the white walnut tree makes up the greater part of the forest. North of Quebec it is less plentiful. The last white walnut tree was found at Baye St.

[5] *Juglans cinerea.*

Paul, which lies 18 French miles north of Quebec. The French living there agreed that they had never found it growing north of the place just mentioned.

Soil. The white walnut, which is rarely found on steep precipices, prefers to grow on gradually sloping banks of rivers and brooks, in dry, loose, rather good soil, and on dry, gently sloping hillsides. It is quite often found in dry places on level ground in forests, and is occasionally seen on dry, stony, poor soil. In a word, the white walnut selects such places as those which the oak prefers here with us.

Time of Flowering. Trees growing where they were well bathed in sunlight began to bloom in Philadelphia on April 26, 1750, new style (which will always be used in the following), but those which were not so favorably situated began to bloom a week later. I do not know at what late date this tree blooms farther north in America, but it produces flowers about a week earlier than any other species of walnut tree in this country.

The leaf buds opened, at Philadelphia, about three or four days after the trees began to bloom in the year just mentioned.

When the Nuts become ripe. They were scarcely more than half ripe at Quebec on August 25, 1749; and did not ripen until September 23 of the same year at Montreal, Canada. At Albany, in order to illustrate a place somewhat further south than Montreal, I found the first ripe nuts on September 12, 1750. The nuts usually ripen earlier on this tree than on other kinds of walnut.

The leaves began to fall at the beginning of the month of October in 1749 at Montreal, and, by the middle of the same month, not a leaf remained on the trees. In Pennsylvania they fell the latter part of the same month in the year 1750.

Characteristics. The nuts are oblong or oval in shape. In this respect they differ from all other known walnuts, which are round or roundish. When green, the surface of the bark on the nuts is far more oily than that of any other type of walnut. When this same green bark is rubbed between the hands, it has an unpleasant smell nearly like that of a he-goat. It also has an unpleasant taste. The green leaves, when rubbed between the hands, give an odor which is scarcely pleasant, but not as evil and rancid as that of the black walnut tree.

Branches and smaller twigs are so brittle that they cannot be bent without breaking. Thus, the white differs from the species of walnut which are called hickory, whose branches are tough and hard to break. I have never seen any insect offer to eat the leaves of the white walnut.

Uses. The tree itself is not good for cabinet work, like the black walnut tree. It does not have a pretty color but is white inside and, therefore, is commonly used for fuel. Some people said that the wood was quite hard and was used for mills, cogs, toothed wheels, and lantern wheels, but they had confused the white walnut tree with the hickory, which is used in that way and sometimes is even called white walnut tree.

In Albany the bark is used to dye wool black. A decoction of the bark, held in the mouth, is famous as a remedy for toothache.

The nuts make this tree valuable. When the tree is tolerably large, it produces a great quantity of nuts each year. In the autumn it is not unusual to see the ground under the tree covered with nuts to the depth of 1 to 1½ *qvarter.*[6] Because the shells of the nuts are thick and hard, they cannot be broken with the teeth. It is necessary to use a hammer or some other hard object to crush them.

The nuts are used in various ways. It has already been mentioned that the outer husk of the nuts is oily. In North America there was not another tree whose fruits pro-

[6] A *qvarter* equals ¼ *aln* or about 6 inches.

duced as much oil as this one. The Indians collect the nuts and cook them in water; when the oil floats to the top, they skim it off with a spoon or ladle and save it. The Indians of both sexes use this oil on their hair in order to make it soft and pliable. When they are tired from much walking or other heavy work, they also grease the body, particularly the arms, feet, and joints. Painters also find this oil useful. It might possibly be used as a substitute for cotton, linseed, and rape oil.

Of all the walnuts in North America, this one stays fresh the longest. On several occasions, I ate some which were a year old, and except for a slight staleness, which could hardly be detected, they were as fresh as when first collected. Likewise, I collected some nuts a short distance from Philadelphia, in 1750. They had been lying on the ground, under the tree, all autumn, winter, and spring, exposed to rain, snow, cold, heat, sunshine, and other changes in weather, but they were as fresh as if they had just fallen from the trees.

The nuts have a fair-sized kernel, not so large as that of the European walnut, but equal to it in flavor. They are, therefore, industriously gathered in the autumn by the inhabitants of the country, particularly those in the northern provinces, who serve them as a confection after meals or mix them with other things to treat afternoon callers. On such occasions, the nuts have been cracked and the kernels removed, so that the kernels only are served. In various places, such dishes are served with afternoon tea.

In Canada, where the nuts are preserved in sugar, they are collected at the end of June or the beginning of July while they are still small, and the shell around them is quite soft. They are then preserved in sugar in the manner which is customarily followed in France in preserving European walnuts. The preserved nuts are set forth at mealtime with other preserves and confections, and they are quite good.

The condition of this tree in Finland. Many trees, which were planted in and around Åbo, came up from nuts which I brought home with me from North America. They have withstood our winters quite well, even better than apple, cherry, and plum trees which have been planted in this country for a long time. It is even more significant that, during the unusually cold winter of 1760, when some of our wild trees such as ash, maple, hazel, and others were injured or killed by the cold, these walnut trees (if I omit those which had been heavily trimmed the previous summer) were not hurt in the least, although some were already 4 *alnar* tall and were far more exposed to the north wind than several of the native trees just mentioned. Details can be found in both the first and second quarter of the Kongl. Vet[enskaps] Acad[emiens] *Handl[ingar]* for the year 1761. In the winter of 1768, which caused such great injury to orchards and gardens, these walnut trees were not injured or inconvenienced in the least. Trees, which are 2 to 2½ *famnar* tall, can be seen in my orchard at Staden, and on the plantation at Sipsalo, as well as at other places.

The walnut trees, which were planted from nuts in the spring of 1758, came up the same summer and began to bloom for the first time on May 29, 1761. Several times since then, they have borne flowers and fruit. Like other trees, they rest some years and do not produce fruit. Here, they usually bloom at the same time as the apple tree, and occasionally on one and the same day.

Only once have I succeeded in obtaining nuts. Although some years the trees have borne much fruit, it has not succeeded in ripening. The last two summers were so cold that the seed of quite a number of our common vegetables did not ripen. The summer of 1766 was quite warm, but—much to my disappointment—the trees did not produce a single nut. Several persons of rank, such as President Lagerflycht, Bishop Mennander,

Lord of Chancery Rappe, and others, have eaten walnuts grown here and found them palatable. From what little experience I have had up to now, I think I have every reason to conclude that, when somewhat longer and warmer summers occur, these trees will be able to ripen their fruits. Other foreign plants introduced here, although at first they had difficulty in producing ripe fruit, have, by degrees, ripened their fruit more rapidly. Here, even in the cooler summers, the nuts yearly reached considerably greater size and strength than those which the women in Canada found suitable for preserving. Each year, therefore, when the trees are not resting, the nuts are large enough for this useful purpose. Upon my arrival from North America, I gave out nuts of this tree and seeds of other American plants in both Götheborg and Stockholm. I cannot say how they thrived on the Swedish side as I do not know.

NEWS NOTES AND COMMENTS

DECEMBER MEETINGS OF THE AGRICULTURAL HISTORY SOCIETY

The Agricultural History Society met with the American Historical Association and other historical societies in Chicago on December 29–31, 1941. The joint session of the society on Monday morning, December 29, consisted of a symposium on "Agricultural Frontiers in the United States." Wendell H. Stephenson of Louisiana State University presided and Rodney C. Loehr, University of Minnesota, considered "Moving Back from the Atlantic Seaboard"; Russell H. Anderson, Museum of Science and Industry, Chicago, "Advancing Across the Eastern Mississippi Valley"; and Everett Dick, Union College, "Going Beyond the Ninety-Fifth Meridian."

"Food and World War I" was considered at the society's luncheon conference on December 29. Everett E. Edwards presided and the following papers were read: "The Food Administration—Educator," by Maxcy R. Dickson; and "Food Purchases of the Allies," by Almon R. Wright. Both the authors are with the National Archives.

The Agricultural History Society also held a joint session with the American Farm Economic Association in New York on December 27, 1941. O. C. Stine of the Bureau of Agricultural Economics served as chairman and the topic "Agriculture in the Last War" was considered. The following papers were read: "Agricultural Prices in World War I—A Comparison with the Current Situation," by J. M. Tinley of the University of California; "The Land Market and Farm Mortgage Debts, 1917–1921," by L. J. Norton of the University of Illinois; and "The Farm Labor Situation, 1917–1921," by Harry Schwartz of Brooklyn College. These three papers are printed in the *Journal of Farm Economics*, February 1942, p. 157–187.

THE 1942 ANNUAL MEETING OF THE AGRICULTURAL HISTORY SOCIETY

The Society held its 1942 annual meeting at the American Legion Club, 2437 Fifteenth Street, N.W., in Washington, D. C., on the evening of May 19. Forty-two attended the dinner and others were present for the business meeting and presidential address. Professor Harry J. Carman of Columbia University, the Society's president, presided.

The annual business meeting began with the report of the secretary-treasurer, Dr. Arthur G. Peterson. The mailing list as of April 30 included 369 paying members, 9 life members, and 25 exchanges, or a total of 403. The net loss of 10 members during the year was accounted for in large part by the mandatory suspensions from the mailing list because of the war declarations. Among the members lost by death was Clifford V. Gregory, editor of *Wallaces' Farmer*, and president of the Society during 1935–36. The secretary-treasurer stated that the financial condition of the Society had continued to improve and that the long anticipated liquidation of the back debt for printing would be effected by the end of 1942.

The report of the auditing committee consisting of Dr. Lazar Volin, Miss Mary F. Carpenter, and Dr. Robert H. Bahmer was presented by Dr. T. C. Schellenberg. It commended the secretary-treasurer's financial statement, and a motion to accept the report was passed.

In the absence of Dr. Carleton R. Ball, chairman of the museum committee, Dr. O. C. Stine read the committee's report which stated that the emergency conditions of the past year had not been favorable to concrete advances. The report also called attention to the old-time threshing floor from a Tennessee farm, which was to be flooded by the reservoir above Cherokee Dam. The floor and related equipment has been given to the Great Smoky Mountains National Park for use in a local museum at some future time. A special report by Dr. F. L. Lewton on the old plows which were transferred from storage at the Arlington Farm of the U. S. Department of Agriculture to the National Museum on October 8, 1941 arrived too late for presentation at

the annual meeting, but it is available in the files of the Society.

Mr. Everett E. Edwards then reported informally on the work of the special committee on the duplication of historical materials. He emphasized the necessity for studying the relative advantages of the two main media of duplication, namely, microfilming and microprinting, before the committee could proceed further.

Professor Harry J. Carman announced the appointment of two committees to arrange the programs for the joint sessions with the American Historical Association and the American Farm Economic Association in December. President Carl R. Woodward of Rhode Island State College, Professor Joseph C. Bailey of Hunter College, and Professor Fletcher M. Green of the University of North Carolina are arranging the program for the luncheon and session of papers for the historical meetings at Baltimore, and Mr. Charles A. Burmeister and Mr. Harry Schwartz of the War Production Board, and Professor Warren C. Waite of the University of Minnesota have charge of the joint session with the agricultural economists.

Dr. Russell H. Anderson of the Museum of Science and Industry, Chicago, reported informally for the special committee to solicit gifts. It was agreed that the committee was to be continued.

With the exception of Article 4, relating to officers, the revised constitution as presented by the special committee on the constitution and bylaws was approved by the membership at the 1941 annual meeting. On behalf of the committee, Dr. Arthur G. Peterson had submitted a report on Article 4 to the entire membership in January and likewise at the annual meeting. This report which provides that the executive committee shall consist of the president, the vice president, the secretary-treasurer, two annually elected members, and the four most recent ex-presidents who maintain their membership in the Society was adopted.

Dr. Peterson also presented the subject of raising the annual membership dues which had been submitted to the membership in January. After considerable discussion, it was voted to amend the bylaws by giving the executive committee the power to raise the annual dues for individuals as well as institutions to not more than $4.

By unanimous vote of the membership, the following were elected as officers of the Society for 1942–43: president, President Carl R. Woodward, Rhode Island State College; vicepresident, Professor James C. Malin, University of Kansas; secretary-treasurer, Dr. Arthur G. Peterson, U. S. Bureau of Agricultural Economics; executive committee, Professor Fletcher M. Green, University of North Carolina, and Miss Lois Olson, U. S. Soil Conservation Service. This election is in accord with the recommendations of the nominating committee consisting of Professor Albert V. House, Jr., Wilson Teachers College (chairman); Dr. F. E. Balmer, State College of Washington; Professor Asher Hobson, University of Wisconsin; Dr. Arthur J. Larsen, Minnesota Historical Society; and Professor Bell I. Wiley, University of Mississippi. In the absence of Professor House, who is with the armed forces, the report of the nominating committee was presented by Mr. Thomas J. Mayock of the U. S. Bureau of Agricultural Economics. Mrs. Edith Warren Quinn of the same bureau presented the results of the balloting.

Following the business meeting, Professor Carman read the presidential address on "Jesse Buel—Early Nineteenth Century Agricultural Reformer." It is to be printed in an early number of *Agricultural History*.

SECRETARY-TREASURER'S FINANCIAL STATEMENT, MAY 1, 1941–APRIL 30, 1942

Balance on hand, May 1, 1941 in checking account at McLachlen Banking Corporation		$609.68
Receipts:		
Membership dues		
1940 and earlier	$48.50	
1941	327.15	
1942	571.42	
1943	3.00	
Contributing	10.00	
Life	63.00	
	$1,023.07	
Back number sales	266.75	
Reprint sales	141.10	
Author's alterations	15.98	
Total receipts		$1,446.90
Total receipts plus May 1, 1941 bank balance		2,056.58
Disbursements:		
Printing		
4 numbers of *Agricultural History*	$1,072.45	
Reprints from 5 numbers	114.43	
Author's alterations	15.98	
Payments on back bills	396.61	
	$1,599.47	
Stationery and supplies	17.15	
Postage	48.93	
Freight charges	4.76	
Mimeograph machine	10.00	
Notices	2.25	
Theft from cash drawer	3.00	
Bad check	3.00	
Total disbursements		$1,688.56
Balance on hand, April 30, 1942 (Checking account in McLachlen Banking Corporation, $305.02; and investment in Interstate Building Association, $63.00)		$368.02
Total accounted for		$2,056.58

WISCONSIN AGRICULTURE

Wisconsin: Loyal Durand, Jr., "Cheese Region of Southeastern Wisconsin," *Econ. Geog.*, 15:283–292, illus. (July 1939), and "Dairy Region of Southeastern Wisconsin and Northeastern Illinois," *ibid.*, 16:416–428, illus. (October 1940). Fred L. Holmes, *Badger Saints and Sinners* (Milwaukee, E. M. Hale & Co., 1939, 570 p., illus.), including sketches of John F. Appleby, Increase A. Lapham, William D. Hoard, Ransom A. Moore, and Hamlin Garland. Stephen Kliman, translator, "Haraszthy's Wisconsin Experience," *Wis. Mag. Hist.*, 23:182–206 (December 1939). William Francis Raney, *Wisconsin: A Story of Progress* (New York, Prentice-Hall, 1940, 554 p.). Theodore Saloutos, "The Decline of the Wisconsin Society of Equity," *Agr. Hist.*, 15:137–149 (July 1941). Leroy W. Schlinkert, "The Charles McCarthy Papers," *Wis. Mag. Hist.*, 23:308–312 (March 1940). Clarence Schoenfeld, "100 Years of Wisconsin Dairying," *Prairie Farmer* (General ed.), 112(4):1, 16, 19, illus. (Feb. 24, 1940). Wilbur Stiles, "Lake Mills: A Dairying Pioneer," *Wis. Mag. Hist.*, 24:446–452 (June 1941). C. B. Scott, "The White Pine Stump Fences of Pine Grove Village, Wisconsin," *Amer.-German Rev.*, 7(1):14–15, illus. (October 1940). Harvey A. Uber, *Environmental Factors in the Development of Wisconsin* (Milwaukee, Marquette Univ. Press, 1937, 265 p.), reviewed by Loyal Durand, Jr., in *Wis. Mag. Hist.*, 23:115 (September 1939). G. S. Wehrwein, "The Economic Status of Isolated Settlers in the Cut-over Area of Wisconsin," *Jour. Land & Pub. Util. Econ.*, 15:184–194 (May 1939). Writers' Program, Wisconsin, *Wisconsin: A Guide to the Badger State* (Amer. Guide Ser., New York, Duell, Sloan & Pearse, 1941, 651 p., illus.).

ROTHAMSTED AND ITS EXPERIMENT STATION

SIR E. JOHN RUSSELL

Rothamsted Experimental Station
Harpenden, England

THE HISTORY OF THE ROTHAMSTED ESTATE[1]

Like many other English estates, Rothamsted goes back to a remote antiquity. The earliest agricultural colonists of England probably did not reach this locality, being defeated by the forest, but by the first century B. C. the Belgic group of Celts had their chief settlement 4 miles to the east, near Wheathampstead, and then moved to Verulam, about 3 miles to the south. They occupied Rothamsted and left some of a hearth, many pot boilers and chipped flints, and some of their broken pottery in a ditch. How they cleared the forest is not easy to imagine; perhaps some memory of the labor survives in the Mabinogion, the Celtic collection of folk tales, where among the tasks set to Kilhwch was the removal of the trees and bushes, burning them on the ground, and spreading the ash as manure. However, as they possessed the large, ox-drawn plow (*carruca*) with an iron colter and share and a moldboard, they may also have had some implement for clearing the forest. Under Roman rule, Rothamsted seems to have flourished, for a shrine or temple was built with flints in Little Knott Field at the end of the first or in the early part of the second century A. D., with a statue looking out to the east, but though some fragments have been found, they are insufficient to show which particular god was venerated there. The shrine was surrounded by a flint wall and within the square enclosure were found three burials of the first half of the second century A.D.; each consisted of an urn containing bones, three screw-neck flagons, a Samian dish, and a cup of rough cast Castor ware; and each was enclosed in a wooden box which had perished, leaving only the nails *in situ*.[2] No doubt there are more there, but they are being left for future excavators armed with greater knowledge. Whoever the governing class might have been, the cultivators were probably the Belgic Celts, and at least two of their farm practices survive: the growing of corn and the chalking of the land. Pliny described how wells were sunk through the clay to the underlying chalk, which was hauled out and spread, leaving a dome-

[1] The Rothamsted Experimental Station will reach its centenary in 1943, and in less stressful times the event would be the occasion for a suitable celebration. Such recognition of the eminent contributions of the oldest agricultural research institution in the world must, however, await the establishment of peace. Meanwhile, Sir E. John Russell has been preparing a number of articles on the history of the Station. The article here printed forms part of this series.—*Editor.*

[2] For a full description, see A. W. G. Lowther, "Report on the Excavation of the Roman Structure at Rothamsted Experimental Station, Harpenden," St. Albans and Hertfordshire Architectural and Archaeological Society, *Transactions*, 1937, p. 108–114.

shaped cavity below.[3] The dressing was heavy and lasted eighty years; no man ever had to repeat it in his lifetime. Crops benefited greatly. This practice continued to our own times, and the Rothamsted fields are still marked with the dells formed when the pits caved in; the soil still contains much calcium carbonate derived from successive treatments.

The Roman overlords left in the fifth century, and the Saxons came in the sixth, probably in the second half. But the old Celtic peoples seem to have remained on as cultivators of the soil; nearby are the Waldens—the "weala denu" or "Valley of the Britons or Serfs"; indeed anthropologists declare that ancient types can still be seen in the surrounding country.[4] The Saxons came probably by infiltration rather than invasion. They left no buildings, but they gave us our name; its oldest form, "Rochamstede," meaning "rook-frequented homestead," shows its origin.[5] As often happened in Hertfordshire, it was only a single farm; there is not and never has been a village of Rothamsted, nor is there any sign of strip cultivation.[6] Even as a farm it must have been small, for it is not included in Domesday Book. It was first mentioned soon after 1200 when it was already a manor.

At the beginning of the fourteenth century, it was held by the Noels who passed it to the Cressys about 1355.[7] Their sons held it till 1525 and then died out, but the daughter remained in possession and married Edmund Bardolph. It was a fortunate marriage for Rothamsted, for he brought money and much improved the house and extended the estate. He bought the adjoining Hoos manor, which had been held by Robert de Hoo in 1292 and by his descendants till 1405. Probably also it was he who acquired Fosters, Sawyers, and Whitlocks fields,—names commemorating former owners, who, though unknown to history are mentioned in sixteenth-century letters. One of his descendants had painted on the dining room wall a picture still well preserved of the siege of Edinburgh Castle in 1583 in which he had presumably taken part though no record of his presence there has been found.[8] But the last of the family got into financial difficulties and in 1623 sold the estate to the Dame Anne, daughter of a Flemish refugee, Gerrard Vanacker. She started life as a rich heiress and

[3] "Petitur ex alto, in centenos pedes actis plerumque puteis, ore angusto, intus, ut in metallis, spatiante vena. Hac maxime Britannia utitur. Durat annis LXXX, neque est exemplum ullius, qui bis in vita hanc eidem iniecerit,"—*Naturalis Historiae*, 17:8.

[4] Dr. John Beddoe has observed more signs of ancient types—dark hair, brown eyes, slight build, and long head—in the district than in most parts of lowland England.

[5] J. E. B. Gover, Allen Mawer, and F. M. Stenton, *The Place-Names of Hertfordshire*, 39 (English Place-Name Society, v. 15, Cambridge, 1938).

[6] The adjacent village of Harpenden, however, had its arable commons divided into strips.

[7] For the Cressy family, see John Wolfe Lydekker, "The Cressy Family of Rothamsted," St. Albans and Hertfordshire Architectural and Archaeological Society, *Transactions*, 1937, p. 144–150.

[8] The identification presented considerable difficulty, but the matter was finally referred to Dr. Margaret Wood, historical specialist on the staff of the city of Edinburgh, who had no hesitation in fixing the date and site, the Lang Dykes, north of the town and Castle. Some repair of the picture was necessary, and this was done by Professor E. W. Tristram.

made two wealthy marriages. The first was to Jacob Wittewronge, son of another refugee who had acquired wealth as a brewer; the second was to Sir Thomas Myddleton, sometime Lord Mayor of London and brother to Sir Hugh Myddleton, the founder of the New River undertaking for London's water supply. Sir Thomas did not long survive. Anne decided that John, then aged five, her son by her first husband, should become an English country gentleman, so she bought the Rothamsted estate. By that time it had pretty well reached its present form, and the farm map is still clearly recognizable; many of the field names and boundaries persisted till 1930. Anne and afterwards John greatly improved the house and enriched it with a beautiful staircase and some paneling; they also added the present Flemish façade, so covering up but not rebuilding the older timber frame house. John Wittewronge held the estate till 1693, having lived at Rothamsted for seventy years, during the last fifty-three of which he had been in complete possession. They were busy, changing years, the most eventful England has ever known: they saw the beheading of Charles I, the Civil War, the rule of Cromwell, the Restoration, the Fire of London, and the Revolution. None of these events dispossessed Wittewronge. He was clearly very tactful, for he was knighted by Charles I in 1641; he was honored as a puritan by Cromwell's party; and in 1660 Charles II pardoned him his support of Cromwell, and two years later made him a baronet. He was a good type of country gentleman; interested in his farm, he served in Parliament and as high sheriff in the County. Further, he continually improved his house and completed the work begun by Edmund Bardolph of transforming Rothamsted manor house into a substantial country gentleman's residence set in a pleasing park. He left behind him a mass of papers including notebooks and diaries containing, it is said, records of weather and of crops. Unfortunately these have never been edited. From his portrait one judges that his life would make an interesting story.

Sir John Wittewronge's descendants held the estate till 1934. Male descendants ceased in 1763, and the estate then passed to a cousin, John Bennet, and later, in 1783, to a nephew, John Bennet Lawes, who was a friend of the Prince Regent. As this was a most costly distinction he nearly brought the estate to bankruptcy. He died in 1822. None of the successors equaled the great Sir John Wittewronge in distinction; but they kept the estate together and carried out the many duties then incumbent on the squire, including much of the work of local government.[9]

The first John Bennet Lawes was succeeded by his son, also John Bennet Lawes, then only eight years old. He lived till August 31, 1900, so that for a second time a Sir John held Rothamsted for the greater part of a century. He added even greater luster than the first Sir John, for it was he who carried out

[9] The history of Rothamsted is given in *The Victoria History of the County of Hertford*, v. 2; and more fully in Bernard P. Scattergood, "The Manor of Rothamsted and the Wittewronge Descent of Sir John Bennet Lawes, F.R.S." Rothamsted Experimental Station, *Records of the Rothamsted Staff, Harpenden*, 4:21–32 (February 1933); and Elnor R. Russell, "Rothamsted Manor House," *ibid.*, 5:23–29 (June 1935).

the field and laboratory experiments which have made the name of Rothamsted famous throughout the world.

John Bennet Lawes was born on December 26, 1814 and educated at Eton and Brasenose College, Oxford, though he stayed there only from 1832 to 1834 when he left without completing his degree and took up the management of his home farm. He described his early pursuits as having been "of a most desultory character."[10] Somehow as a boy he had acquired a taste for making chemical experiments which he did at home, there being no science in those days at Eton. At Oxford he attended Dr. Charles Daubeny's lectures and must have known of his intended experiments at the Botanic Garden, for his own field experiments, described later, were on the same model. One of his first acts on taking possession in 1834 was to convert one of the best bedrooms into a chemical laboratory "fitted up with stoves, retorts, and all the apparatus and reagents necessary for chemical research", much to the distress of his mother, with whom indeed one can sympathize as there was certainly a lively risk of burning down the whole house. His first experiments were with drugs, and he grew many medicinal plants on the farm, including poppies, hemlock, henbane, colchicum, belladonna, etc. Then he began to apply chemistry to agriculture and soon discovered the value of superphosphate of lime as fertilizer. With characteristic energy he took out a patent and started manufacture. After certain vicissitudes, the business prospered, and he acquired a considerable fortune. But he continued the field experiments, and from the outset kept them quite distinct from the factory.

Lawes was a man of sound judgment and very shrewd business ability. He possessed the great gift of choosing his staff well. Everything he touched succeeded. Between 1848 and 1852 his patents were assailed, but he defeated or bought out his assailants and came out victorious from all his difficulties. From 1852 onwards the financial position of Rothamsted was secured and a period of great prosperity set in. All the debts were cleared off. The large drawing room was added, the estate was enlarged, the woods around the house were extended and the park improved.

Like his great ancestor Lawes had all the interests of a country gentleman. He looked after his farm, and the village, and his workers, whom he ruled with a mixture of kindness and firmness. In order to give them something better to do than to sit in the beer house at night he set up allotments in 1857 and built a club house to be run by the men on their own lines, subject only to the condition that everything was to be done decently and in order.[11] Lawes personally

[10] The biographical note in 1888 by Sir John Bennet Lawes to John Chalmers Morton in the *Agricultural Gazette*, 38:104–105 (July 31, 1893), reprinted in the *Records of the Rothamsted Staff, Harpenden*, 2:6–8 (July 1930).

[11] Dickens visited the clubhouse one evening and wrote a characteristic and very sympathetic account which appeared under the title, "The Poor Man and his Beer," in *All the Year Round*, Apr. 30, 1859. It is reprinted under the title, "Charles Dickens Visits Rothamsted," in *Records of the Rothamsted Staff, Harpenden*, 3:12–19 (November 1931). For Lawes' account, see "The Rothamsted Allotment Club," Royal Agricultural Society of England, *Journal* (ser. 2), 13:387–393 (London, 1877).

attended in order to run a savings bank and a pig club, but he would tolerate no rival. When Joseph Arch started a farm laborers' union in 1872, Lawes laid down one of the big arable fields—the Great Field—to grass as a warning to any who wished to join. "If you can do without me," he said, "I can do without you."

Meanwhile the fame of the Rothamsted experiments was growing, and visitors came from all parts of the world. They were received with the copious hospitality that the times required. Unlike many other squires, Lawes kept his head when money came in; he made no lavish changes in the house, and did not indulge in social display, in gambling, or in other forms of dissipation. He lived simply, and loved wandering through his fields dressed in an old suit and making observations as he went. His holidays were spent in Scotland and he never traveled abroad; he was not interested in art, literature, or general culture; he set up no picture gallery and never assembled a library worth the name. But he kept on steadily at his work and was rewarded with great wealth. In 1872 he sold his manure business for £300,000, but this was only one of his successes. Ten years later he was made a baronet, and honors were bestowed upon him by foreign governments, academies, and universities. He died at Rothamsted on August 31, 1900 in his eighty-sixth year after a very brief illness.

He was succeeded by his son, Charles Bennet Lawes, then aged fifty-seven, who thereupon assumed the ancestral name of Wittewronge. Sir Charles inherited neither his father's scientific interests nor his business ability. He was a sculptor by inclination, and several pieces of his work are in the grounds. He was a fine looking man of good physique and an athlete of distinction. In his youth he had been involved in a costly law suit, a *cause célèbre* in its day, the *Lawes* v. *Belt* case, the costs of which had never been paid so that he had to take them out of his inheritance. He immediately began to make great alterations in the house. The Victorian grates which had been built into the old open hearths were removed and replaced by seventeenth century fireplaces and overmantles from Rawdon House, Broxbourne, or by structures on the same lines. The Victorian wallpaper was stripped off the hall and replaced by linen pattern paneling from Clare, Suffolk, or by modern work by a skilled craftsman, Andersen, a Dane, who spent some years at the house. The incongruous and ill-proportioned nineteenth-century drawing room was remodeled and ornately paneled, and a library was added, though curiously enough it never seems to have had any interesting books and it soon became a billiard room. All the Victorian and earlier furniture was cleared away and replaced by old furniture; a sixteenth-century elm table, a renaissance cupboard of Henry VIII's time, Charles II cane chairs, Georgian wardrobes, Louis XV clocks, Flemish tapestries —the kind of things that, in Sir Charles' view, successive generations of owners might have added had they possessed the necessary taste—which apparently they never had. The house became a show place and museum rather than a country home. Vast sums of money were spent and dealers soon learned Sir Charles' requirements and did their best to supply them.

Unfortunately he died in 1911 after a very brief illness, and the income had

been so reduced that the family could no longer live there. His only child, John, born in 1872, had been living for some years in Australia, and neither he nor any of his children were in a position to live at the house. It was therefore let to Major R. B. Sidebottom and his wife, the Honorable Mrs. Sidebottom, who tended it with care.

Meanwhile the costs of running a large country house were mounting, and growing taxation heavily curtailed the number of people who could do it. The Wittewronge family decided, therefore, to sell the estate, and in accordance with English custom they offered it first to the Rothamsted Experimental Station as tenant of the home farm and part of the park.

That was in May 1931. A telephone call came from the office of the public trustee who managed the estate. It was one of the shortest but most important calls we ever had. "We propose to sell the Estate, will you buy it?" Knowing that certain speculative builders would willingly secure it if we did not, there could be only one answer. I replied that we would purchase it and arranged a meeting to settle procedure. This took a long time but finally on March 16, 1934, the contract to purchase was signed. The basic price was £30,000 subject to certain adjustments and the taking over of various liabilities. We had eight weeks in which to raise the funds.

The Ministry of Agriculture was quite unable to help, being still hampered by the financial crisis of 1931. The possibility of a loan or the sale of securities was considered; both courses were rejected as being prejudicial to the institution and in any case a sign of incompetence on the part of the director. The only course open was to make a public appeal and hope to raise the £30,000 in eight weeks. Happily the press took a very lively interest in the scheme and helped greatly. Subscriptions came in, at first slowly, then more rapidly after Robert McDougall's magnificent gift of £15,000, and donations by the Halley Stewart Trust of £5,000 and the Carnegie Trustees of £2,000 and substantial sums from the Royal Agricultural Society, the National Farmers Union, the Sugar Beet Factories, the Imperial Chemical Industries, and others. Help came from all classes of the community—from village schools, groups in market places, farmers large and small, and country people stranded in towns, revealing a hold that Rothamsted had on the imagination of the countryman that was gratifying in the extreme. As a result, £35,000 was raised in seven weeks.[12]

So the estate passed to the new owners, the fourth since the year 1300: first the Noels, then for nearly three hundred years the Cressys and Bardolphs, then for another three hundred years the Wittewronges and Lawes, and now the Lawes Agricultural Trust, the governing body of the Rothamsted Experimental Station.

The house had been successively a small and unimportant manor house, a country gentleman's residence, and then a show place stocked with rare furniture and beautiful fittings. The Experimental Station did not buy these, and at a

[12] E. John Russell, "The Purchase of the Estate," *Records of the Rothamsted Staff, Harpenden*, 5:10–15 (June 1935), contains the full description.

later date they were sold, the best of them at Christie's, the others locally. What may happen after the war it is impossible to forecast, but if the house survives, a use will be found for it; so beautiful and distinctive a building could not be wasted. A plan has already been drawn up, but whether it or some other will be put into execution remains to be seen.

Meanwhile certain changes were made on the farm. Field boundaries which for generations had followed a sinuous course (as usual in this part of Hertfordshire) were straightened to facilitate tractor work; hedges were grubbed; unnecessary trees removed; and an excellent block of farm buildings put up. Lawes had set up 75 acres of wood: this was too small to justify the appointment of a forester but too large to be left wild; much of it had in any case to be felled, and trees which had been planted in Napoleonic times in readiness for a future invasion were cut down in the present war. As far as possible 19 acres were left as a setting for the house; 16 acres were replanted with ash, beech, and oak; and the remaining 40 acres is being converted into grassland. The whole estate is now devoted to the application of science to the improvement of country life.

THE ROTHAMSTED EXPERIMENTS; THE BEGINNING OF THE ARTIFICIAL FERTILIZER INDUSTRY

Considerable changes were going on in English country life when John Bennet Lawes left Oxford to take active charge of his estate in 1834. The Reform Act had only recently (1832) been passed, taking the government of the country out of the hands of the landowning classes who had long held it, and handing it over to the middle classes whose interests were already largely urban. But for this Lawes might have gone into Parliament as some of his ancestors had done. The Napoleonic Wars had left a terrible aftermath of economic difficulties, and several Select Committees of the House of Commons had inquired into the depressed conditions of agriculture. The 1833 Report was very gloomy; scarcely a solvent tenant farmer remained in the Wealds of Kent and Sussex, and many farmers had lost everything and were working on the roads. Wages were pitiably low; a usual good rate of pay was 2 shillings per day of 10 hours for a man, 1 shilling for a youth, and 6 pence for a child.

Against this were certain hopeful factors which gained in force as time went on and caused a steady improvement in the position. The towns were growing; people were earning more money and able to buy more food. Transport also was improving. It is always in periods of rising prices that farmers do best, and the improvements just beginning operated favorably for nearly fifty years. Further, the spirit of inquiry and improvement was growing among farmers and landowners. This had started in the eighteenth century with some of the large landowners. Agricultural societies were springing up, and the Bath and West Society had its chemist and its laboratory for the analysis of soils and manures.

Just how and when Lawes began his agricultural experiments is not at all clear. He was never a great reader, and it does not appear that he studied the current books on agricultural science by Humphry Davy, Théodore de Saussure,

Albrecht Thaer, and others. At Oxford he attended Professor Charles Daubeny's lectures and presumably knew about the experiments to be made at the Botanic Garden in which crops grown continuously were compared with the same crops grown in rotation; Daubeny described the scheme to the British Association in 1834, and it had much in common with the plan which Lawes himself adopted later. For some time after returning to Rothamsted in 1834, he seems to have kept chemistry and his farming distinct, making the ordinary chemical experiments of the time and preparing extracts of the medicinal plants he was growing. He left no diary, and the only records of the early days are the notebook for 1841 and 1842; the sworn testimony given in lawsuits in 1850 and 1853 by himself and his laboratory man, Henry King, who had been his "fag" (nowadays "scout") at Oxford and whom he had brought to Rothamsted; a four-quarto page statement written by himself, undated, but coming to us in the same bundle with the law papers; and a letter which he published in the *Agricultural Gazette* in 1893.[13]

Of all these the lawsuit papers must be presumed to be the most accurate. In his evidence King stated that he had been engaged by Lawes in the spring of 1839 to help with the experiments then in progress on "artificial manures," and that Lawes was frequently engaged in his laboratory. Lawes then explained what the experiments were: in 1836, 1837, and 1838, he had used considerable quantities of bone dust on turnips but without result; in 1839, 1840, and 1841, he experimented with bones, burnt bones, and mineral phosphate decomposed by sulphuric and other acids. The experiments in 1839 were on a small scale only, made in pots or on a certain number of plants in the field, but the results with turnips were so remarkable that in 1840 he used the superphosphate on half an acre or more of land and applied it to grass and other crops. Further, in the spring of 1840, he engaged a chemist, named Dobson, from University College, London, to help with the experiments; he secured also a new source of raw material, spent animal charcoal (charred bones) from sugar refineries. In 1841 he used 20 tons of superphosphate and bought 30 tons of this animal charcoal. He was so impressed with the result that he proposed to take out a patent but was dissuaded by his friends; in 1841 a gentleman did not engage in trade, least of all in the manure trade. But their scruples were either overcome or ignored, for he duly took out a patent on May 23, 1842, for the manufacture of superphosphate from bones, bone dust, bone ash, apatite, phosphorite, and other substances containing phosphate of lime.

Unfortunately, in his evidence Lawes did not deal with the experiments chronologically, and as no notebooks for 1839 remain we do not know why Lawes tried the effect of acid on bones in 1839, and whether he included mineral phosphate in that year. In the 1893 letter he said that his attention was first directed to the bone problem by a neighboring landowner who asked him why bones were unsuccessful on heavy soils such as his own but very effective on lighter ones,

[13] See footnote 10.

and this set him thinking chemically. The late Marlborough Pryor, who knew Lawes well, confirmed this statement and told me that the neighbor was Lord Dacre of Kimpton Hoo. Actually the question had already been put in a report of the Doncaster Agricultural Association in 1829, and it was clearly engaging the attention of thoughtful agriculturists, for it was given a prominent place in the well-considered program of research drawn up by a committee of the English Agricultural Society and presented to its annual meeting in May 1839. This was the forerunner of the Royal Agricultural Society, and it had many members, though I cannot find that either Lawes or Lord Dacre was among them.

The undated statement, however, gives a somewhat different account. After stating that "in the year 184 [*sic*]" he had been asked by a city broker if he could "find some use for spent animal charcoal" he continued:

> At that time I was engaged upon a series of experiments upon the action of manures and told him to purchase a quantity for me which he did. . . . In the summer of 1841 I commenced a series of experiments with this burnt bone for the purpose of ascertaining the cause why bones produced no beneficial effect upon my soil . . . one portion of the land was manured with burnt bone ground to powder, and another with this substance mixed with sulphuric acid. A variety of experiments was tried in which the sulphuric acid and bones were mixed with salts of potash, soda and magnesium, and the field was sown with turnips. . . .The combination of burnt bones with sulphuric acid produced extraordinary results upon the turnip crop . . . accelerating the growth of the young plant, forcing it through the early stages of its growth in a shorter time than any other substance known. This is a very important element in obtaining a crop of turnips as it is very liable to be destroyed by a small fly which feeds upon it as soon as it appears above the ground; no year passes without many thousand acres being destroyed by this fly. As an experiment in agriculture can only be tried once in the twelve months and it was thought desirable to repeat this, the patent was not applied for till 1842 and it was sealed on May 23rd.

Meanwhile another development was going on which was destined profoundly to affect the Rothamsted experiments, though we do not know when its influence began. The distinguished German chemist, Justus von Liebig, had in 1837 attended the Liverpool meeting of the British Association and urged British men of science to study organic chemistry "which, when taken in connection with the researches in physiology, both animal and vegetable, which have been so successfully prosecuted in this country, may be expected to afford us the most important and novel conclusions respecting the functions of organization."[14] Even at that early date the mode of dealing with such a request was well understood; Liebig was invited to prepare a report on the state of organic chemistry and organic analysis. This never came; instead, in 1840 he published a volume, *Chemistry in its Application to Agriculture and Physiology*, stating in the introduction that it was a report presented to the British Association, though it was not mentioned in the proceedings of any of the meetings. This is undoubtedly one of the most important publications in the whole of agricultural

[14] See the section of "Notices and Abstracts of Communications to the British Association . . . ," 41, in British Association for the Advancement of Science, *Report . . . 1837*.

science, and it determined the direction of the Rothamsted experiments for sixty years.

Liebig did not himself make experiments but brought together the results of plant physiologists and deduced from them the principles underlying the nutrition of plants. Prior to 1840, humus had been regarded as the source of carbon for plants. Liebig pointed out that the carbon came from carbon dioxide in the air, that it was available in unlimited quantities, and need not, therefore, be supplied. The nitrogen came from the ammonia in the air, also unlimited in amount, and consequently need not be supplied. On the other hand, the ash constituents, potassium, sodium, magnesium, calcium, phosphates, and in the case of cereals, silica, came from the soil and might easily be lacking; it was these, therefore, that must be given as manures. Analysis of the ash of a normal crop showed what quantities of the various constituents were present; analysis of the soil showed whether it contained sufficient; if not the deficit must be made up. Manuring thus became an exact science, a matter of analysis and arithmetic. All this was completely revolutionary and had it come from anyone less than Liebig it would probably have been ignored. Farmers could hardly be expected to believe that manures should be mineral, not organic, as had been supposed from the beginning of agriculture. Another deduction profoundly affected Lawes: it was that the necessary phosphate could come from bone, and its effectiveness could be increased by dissolving it in sulphuric acid, mixing with water, and spraying it on to the land before plowing. This was not a very practicable suggestion and never came into common use; Daubeny did not mention it in his Oxford discourse on manuring in 1841,[15] and even Liebig himself did not follow it up; when mineral phosphates were discovered in quantity he recommended that they should be burnt and then ground for manure; he made no mention of the possibility of converting them into superphosphate.

As already stated, we do not know the details of Lawes' 1839 and 1840 experiments. The experiments for 1841 and 1842 are, however, recorded in a notebook written by Lawes and still existing. There were a considerable number of them, and both Dobson and King must have been kept very busy. The plan of the 1841 series shows that a considerable amount of sorting out had clearly been done during the two preceding years so that Lawes now knew what substances to use in the field trials and approximately in what quantities. The summer field experiments were on turnips on plots of 1/30th of an acre and the scheme included: Series 1, phosphate of lime (source unspecified) plus sulphuric acid in several diminishing doses; Series 2, as 1, with addition respectively of carbonates of magnesia, lime, potash, soda; Series 3, as 1, but bones instead of phosphate of lime; Series 4, as 2, but bones instead of phosphate of lime; Series

[15] Charles Daubeny, "On the Scientific Principles by Which the Application of Manures Ought to be Regulated," Royal Agricultural Society of England, *Journal*, 2:232–258 (London, 1841).

5, as 1, plus sulphate of ammonia or nitrate of soda; Series 6, various substances, e.g. sulphate of ammonia; soot, used alone; and unmanured.

The purpose was clearly to discover how much acid was necessary to obtain the most effective result and whether anything was gained by neutralizing the superphosphate with an alkaline carbonate bringing about "reversion." The good effects of sulphate of ammonia and of nitrate of soda had also evidently been established.

There is no indication in these experiments that Lawes knew of Liebig's views. It is possible that he had heard of them by the autumn of 1841 for the grass and wheat experiments begun in October and November include a series on silicate of potash, though nothing on the alkalis such as one would expect of a systematic study.

The 1842 experiments are much more extensive, and include pot experiments testing many simple salts, and a large number of field experiments still testing various mixtures of sulphuric acid with phosphate of lime, bones, and apatite, but no mention is made of spent charcoal. The influence of Liebig is suggested by the facts that the ashes of straw, hay, and farmyard manure were also tested, and the rain water was collected and analyzed to see how much ammonia it contained.

The patent was taken out on May 23, 1842. It comprised three parts:—

1) Chemically decomposing for purposes of manure by means of sulphuric acid of Bones, Bone Ash or Bone Dust or Apatite or Phosphorite or any other substance containing phosphoric acid;
2) compounding and use for purposes of manure of a mixture of phosphoric acid with any particular alkali, as Potass or Soda or magnesia or ammonia, or any earth containing such alkalis;
3) production and use for purposes of manure of a combination of silica in the state of ground flint or sand with either of the alkalis Potass or Soda, or of the application for purposes of manure of crystal or glass ground to a state of powder.

The patent had, however, certain weak points. Superphosphate was well known to the chemists of the time, and its preparation from the insoluble calcium phosphate of bone ash by treatment with sulphuric acid was described in all the textbooks; and the reaction was indeed used for the manufacture of phosphoric acid and of phosphorus. In his specification, by way of example of the mode of preparation, he gave figures practically identical with those in D. B. Reid's *Elements of Chemistry* (edition 3, 1839), his copy of which still survives. And moreover Liebig had published his recommendation in regard to dissolved bones in 1840. The patent, however, was granted. But Lawes was only just in time. While the formalities were proceeding, another patent was also lodged by Sir James Murray, with the totally different purpose of generating carbon dioxide in the soil, but the agent used was sulphuric acid dried by various substances then mixed with a carbonate and added to the soil. Under the action of rain

and dew this would produce carbonic acid in the soil. One of the mixtures recommended was sulphuric acid and calcium phosphate, with one or more of the enumerated absorbent substances. Lawes raised objections but deemed it wisest to buy out the patent in January 1846. It had the great advantage of securing him the right to use gypsum as a drier. Meanwhile he was proceeding with the manufacture. He secured a factory at Deptford Creek, London, and on July 1, 1843, there appeared this modest advertisement in the *Gardeners' Chronicle:*

J. B. LAWES'S PATENT MANURES, composed of Super Phosphate of Lime, Phosphate of Ammonia, Silicate of Potass, &c., are now for sale at his Factory, Deptford-creek, London, price 4*s*. 6*d*. per bushel. These substances can be had separately; the Super Phosphate of Lime alone is recommended for fixing the Ammonia of Dung-heaps, Cesspools, Gas Liquor, &c. Price 4*s*. 6*d*. per bushel.[16]

At first Lawes used bone ash as his chief source of phosphate, the mineral phosphates being too scarce. Some supplies came from the Crag in Suffolk and the Greensand in Surrey, but Lawes in June 1845 complained that the owners of the Felixstowe Coprolites "have such an exaggerated notion of their value" and asked £14 per ton, which was too much. He sold his superphosphate at £7 per ton.

The business was clearly very profitable and others began to embark on it. In the early part of 1848, Lawes discovered considerable infringements by the London Manure Company and others, and with characteristic energy he proceeded to take action against them. He began in February disclaiming bones and bone dust, which he could not have defended, then in July he started proceedings at Bristol, it being too late to act in London. But the law moved slowly in those days; there were pleas and demurrers, and it was not till December 1850 that the case came on at the Guildhall, London, *Lawes* v. *Purser*, and others, under Lord Chief Justice Baron Pollock. The verdict was in the main for Lawes; he retained his title to the patent but with some qualifications, and the best way out of certain resulting difficulties was judged to be a second disclaimer, which was effected in November 1857, of bone ash, and of parts two and three, the latter on the score that "they had not come into such general practical use as to make it desirable to retain them as part of the Patent."

Meanwhile, the infringements by the London Manure Company still continued, so Lawes started another action in November 1851, but the company this time withdrew. Lawes pointed out to them in a letter in January 1852 that they could use bones and bone ash but not mineral phosphate. He granted them a license, however, to use mineral phosphate on payment to him of a royalty of 10 shillings per ton of phosphate used. Edward Packard & Company of Ipswich had also been making superphosphate; they also came to terms. Mr. Fison of Thetford did not at first. But the troubles were not yet ended. The restrictions imposed by Lawes became more and more galling when mineral phosphate began to come on the market in quantity, and in March 1852 manu-

[16] *Gardeners' Chronicle*, July 1, 1843, p. 442.

facturers and dealers in superphosphate met at the Green Dragon, Bishopsgate Street, to present Purser with a piece of silver plate for his spirited action against Lawes and to consider "the propriety of resisting the attempt now making by Mr. J. B. Lawes to establish an exclusive right to the manufacture and sale of this article, and it was resolved to resist by every justifiable means and to open a subscription list for the purpose."

Lawes accepted the challenge. He began (March 1852) with yet another disclaimer, this time of most of the Murray patent, retaining only the use of the drier, but this was not entirely allowed. Finally in November 1853 the trial came on; *Lawes* v. *Batchelor* this time. There were fourteen pleas. Lawes' council advised a heavy array of scientific evidence, and it was forthcoming. Much time was spent in arguing whether apatite and phosphorite were or were not old bones; if so the patent would fall; so also would it if there were an apatite that would not yield superphosphate. There was discussion as to whether coprolites, which were discovered after the patent, could be covered by the clause "any other substance containing phosphoric acid." The essential weakness of the case, the fact that the reaction had long been known and used, was pointed out by the Attorney General, Sir F. Thesiger: "if the patent is valid it leads to the extraordinary consequence that a person may manufacture superphosphate of lime for one particular purpose but cannot manufacture and use it for agriculture." But the validity of the patent had in the earlier trial been upheld and could not be disputed.

Sir F. Kelly made his concluding speech on November 11. Stress was laid on the fact that Lawes had from first to last spent some £10,000 on experiments and was then spending on them at the rate of £1,500 per annum, and was freely publishing the results for the benefit of agriculturists. The hope was expressed that he would not be "deprived of his Patent by the application of any hypercritical construction of language . . . or especially upon any claptrap pretence of promoting the Public Advantage by putting an end to a temporary monopoly fairly granted in his favour but yet a very inadequate compensation for the large amount of time and labour and money he has expended."

The verdict was given for Lawes on ten pleas and against him on four out of the fourteen presented; it was a complicated one which only a patent law expert could expound. But it had the effect of establishing Lawes' position with absolute security and stopping all further infringements. From then on there was peace in the industry, and Lawes was able to develop the factory. In 1857 he purchased about 100 acres of land at Barking Creek and erected a larger factory, including an extensive plant for the manufacture of sulphuric acid; the business continued to flourish, and in 1872 he sold it to the Lawes Chemical Manure Company for £300,000.

THE ROTHAMSTED EXPERIMENTS; THE LAWES AND GILBERT EXPERIMENTS, 1843–1900

On June 1, 1843, Joseph Henry Gilbert came to Rothamsted to replace Dobson who had left for Australia. Gilbert was then twenty-six years of

age, having been born at Hull on August 1, 1817,[17] and he had had an unusually full scientific training. He came of a literary family; his father was the Reverend Joseph Gilbert, a well-known Congregational minister and afterwards classical tutor at Rotherham College. His mother was, before her marriage, Ann Taylor, a well-known writer of verse for children, including *My Mother* and *Meddlesome Matty*, and an autobiography which can still be read with interest. Both parents are given a place in the *Dictionary of National Biography*, a distinction accorded to none of Lawes' ancestors. When only fifteen years old, Gilbert had a serious gunshot accident and lost his left eye and seriously damaged the other. At twenty-one he visited St. Petersburg; he then studied chemistry for a year at Glasgow; he transferred to London in 1839 to study under Professor Thomas Graham at University College; then in 1840 he went for a summer session under Liebig at Giessen, where he obtained his Ph. D.; Lyon Playfair was one of his fellow students. He then returned to University College as assistant to Professor A. T. Thompson, but in 1842 he was appointed chemist to a calico printer in Manchester named Burd, leaving there after a few months for Rothamsted.

With the arrival of Gilbert, the experimental program changed completely, both in direction and in character. The work on superphosphate came to an end, and henceforward the field experiments were kept quite apart from the factory and its problems; indeed Gilbert stated in his evidence at the lawsuit that he only went there two or three times a year. The purpose of Gilbert's work was, in his own words, "the investigating of the scientific problems involved in agricultural processes."

There is nothing like a hypothesis to form the basis of an experimental program, and Gilbert's session at Giessen had made him fully acquainted with Liebig's "mineral hypothesis" which in some important respects did not accord with Lawes' field results. Probably through Gilbert's offices, Lawes was introduced to Liebig by Graham in December 1843,[18] but there is no record of their meeting.

Lawes and Gilbert made an admirable combination. Lawes was the shrewd, practical man of affairs who could see a problem in its proper perspective and devise a direct way of dealing with it. But he was impatient of detail and lost interest in an inquiry once he was satisfied that a solution had been found. The pages of his only notebook show what he was aiming at and the result obtained, but the observations he had intended to enter were either never made or never recorded. Gilbert, on the other hand, was a student, a reader of books, much

[17] "He wants nothing but a name," his mother wrote just after he was born, "which we are quite at a loss about. I should like to call him 'Isaac' but Mr. Gilbert does not like it, and nobody thinks it pretty. Indeed I cannot deny there's nothing but association in its favour." Gilbert did not like his name "Joseph," and there is no record as to his views on "Isaac."

[18] The letter from Thomas Graham to Liebig which introduced Lawes is printed in the *Records of the Rothamsted Staff, Harpenden*, 3:7–8 (November 1931).

devoted to detail, very unwilling to change, and meticulously accurate in everything he undertook. He left many notebooks; all the sums are right, but it is impossible to see what they are about. He would have no truck with short cuts—no logarithms or slide rules—nor would he ever use the metric system. He was extremely methodical, and from the time of his arrival he kept very full records of crop yields and analytical and other data which, once begun, were never discontinued. Throughout his fifty-eight years at Rothamsted, there are hardly any gaps in the records. His papers are long and so loaded with tabular matter and statement of fact as to be tedious reading to the modern generation of students, but all the details of experiment and of observation are as accurate as he could make them. The long continuance of the field experiments was due to him; Lawes actually ordered them to be finished and plowed up, but Gilbert persuaded him to let them go on.

Like many of their contemporaries, both Lawes and Gilbert were keen controversialists and loved to assail a hypothesis. They accepted Liebig's view that plants draw their carbon from the atmosphere and need not therefore be supplied with organic manure, but must receive mineral manures in order to furnish the necessary phosphorus, potassium, calcium, etc. But they vigorously controverted Liebig's statement that nitrogen also came from the air and need not be supplied. Without exception all their field experiments were designed with the chief purpose of disproving Liebig's view. The experiments on wheat, barley, swedes, mangolds, potatoes, oats, and grass laid out at Rothamsted between 1843 and 1880, and those on wheat and barley at Woburn begun in 1876 were all on the same lines; they included invariably the same treatments: No manure; nitrogen only; minerals only; nitrogen + minerals; farmyard manure.

The nitrogen plots usually were in two groups: sulphate of ammonia and nitrate of soda; usually there were two doses, and in the case of wheat and grass three; the mineral groups were usually split to show the effect of potash and of phosphate.

There were two general designs: the long strips used for wheat and grass, and the cross-dressed strips used for barley, swedes, mangolds, and potatoes, and the rotations, where the scheme was simplified. In no case, however, is the information about phosphate complete; the series included N, NP, NPK, but not NK. Only in one case, mangolds, did the treatment include both farmyard manure alone, and farmyard manure + N; +NP;+NPK. It is thus not possible to work out the interactions of P and K or of farmyard manure and N, P, and K.

What the experiments did show, however, was the vital need for abundant supplies of nitrogen for all these crops, and for mineral manures in order to ensure the full action of the nitrogen. Barley and swedes stood in special need of phosphates; and mangolds, sugar beets, wheat, and the clover in grassland, of potash. The period 1850 to 1860 is the peak period of Lawes' and Gilbert's scientific work. In addition to the field experiments which were rearranged and put into their final form, a considerable amount of laboratory work was done and

indeed all their scientific investigations of the later years were begun during this time. Both men were at the optimum age for striking new ideas: thirty-five to forty-five, after which few men get hold of anything fresh unless through contact with some younger mind, opportunities for which Lawes and Gilbert lacked. They had chemical and botanical assistants, but Gilbert tolerated neither criticism nor independent investigation in the laboratory: he was a martinet in discipline, and most of the work was done by village boys and men whom he trained to do certain processes, and to do them extremely well.

The nitrogen problem in its various aspects still remained their chief concern. Not satisfied with the evidence from field experiments of the inability of plants to draw their nitrogen supplies from the air, they set up a laboratory experiment in which plants were grown in pots under glass shades in conditions where no ammonia could obtain access. The soil was burnt, pots and glass shades were cleaned, and the air was washed through acid. In one series no nitrogenous fertilizer was added; in a second series there was a small addition. In all cases, however, the nitrogen in the fully grown plant was equal to and never greater than the nitrogen in seed and manure if any.[19] This work was done in conjunction with an American, Evan Pugh, who after spending some time at Rothamsted, returned to the United States and became the first director of the experiment station at State College, Pennsylvania.

Liebig did not accept Lawes' evidence. In March 1855, he wrote: " . . . all the experiments of Mr. Lawes prove exactly the reverse of that which in his opinion they ought to demonstrate. Nay, I regard them as the most incontestable proofs in favour of that very doctrine, which they were originally intended to disprove." He then went on "to premise a few words on the true method of experimenting in general, and on its significance, as well as on the relation which exists between the chemist and the art of agriculture. This relation is very commonly inaccurately apprehended, and from such erroneous notions arise the most singular misunderstandings."[20] He further announced his intention of attending the forthcoming British Association meeting at Glasgow. Lyon Playfair was president of the chemistry section and invited Gilbert to attend in order to meet the attack that would certainly come. Gilbert was very reluctant to do so but Playfair insisted: staying away would be "tantamount to a confession of defeat . . . the odds are against you . . . .To compensate for this your best plan would be to become the challenger instead of waiting for the challenge. . . . "[21] So Gilbert went, and there seems to have been a first-

[19] John Bennet Lawes, Joseph Henry Gilbert, and Evan Pugh, "On the Sources of the Nitrogen of Vegetation; with Special Reference to the Question whether Plants Assimilate Free or Uncombined Nitrogen," Royal Society of London, *Philosophical Transactions* (1861), 151:431–578.

[20] *Principles of Agricultural Chemistry, with Special Reference to the Late Researches Made in England*, 2 (London, 1855).

[21] Letter from Lyon Playfair to J. H. Gilbert, Aug. 6, 1855, printed in *Records of the Rothamsted Staff, Harpenden*, 4:10 (February 1933).

class fight, for Gilbert afterwards bitterly complained of the "utter want of consistency and valid argument" of Liebig "wanting . . . in the integrity even of a gentleman, and in any decent observance of the requirements of logic . . . thanks to his own temper and obstinancy, we cannot now spare him as we would."[22] So a portentous reply was prepared and sent to the *Journal* of the Royal Agricultural Society; the editor, however, with all due deference felt unable to publish it in full and only the expurgated edition survives.[23] Lawes would not let the matter rest there; he proposed to translate their full reply into German and French and circulate it on the Continent. But he had bad luck with his translators: the German took a long time about it, and Eugène Risler advised Gilbert against the translation into French. It was a time when men said exactly what they thought about each other, and Liebig was a past master in the art; he made a vigorous rejoinder, first in the *Familiar Letters of Chemistry* and finally in 1862 in his *Einleitung in die Naturgesetze des Feldbaues*, which was translated into English under the title, *Natural Laws of Husbandry*. Gilbert criticized the translator for softening the vituperation; he complained about the "wholesale abuse and almost systematic unfairness of statement," and asserted that "Liebig's professed quotations are almost always mutilations of the original."[24]

This nitrogen controversy was the center of Gilbert's life. Apart from the fact that he traveled to attend scientific meetings at the British Association and in Germany (then a leader in intellectual matters) he had no other interests. A lady whom he took into dinner and who was rather proud of being the partner of so distinguished a man complained afterwards that he had talked to her only about the nitrogen problem and Liebig's "mineral hypothesis."

In another matter, also, Lawes and Gilbert fell afoul of Liebig. In their experiments on the feeding of animals they had come to the conclusion now universally accepted that fats and carbohydrates supply the energy for work performed in and by the body. Liebig, on the other hand, maintained that the nitrogenous foods supplied the energy material, and the work could be estimated from the nitrogen appearing in the urine. On one point, however, they agreed with Liebig: the source of fat was not simply pre-existing fat but also carbohydrates.

These feeding experiments were carried out at various times between 1848 and 1862. The results obtained compare very well with the more modern data and show that there has not been much change in the economy of fatting English livestock in spite of more rapid growth:

[22] Letter from J. H. Gilbert to Augustus Voelcker, October 1855, quoted in *Records of the Rothamsted Staff, Harpenden*, 4:11 (February 1933).

[23] J. B. Lawes and J. H. Gilbert, "On Some Points Connected with Agricultural Chemistry," Royal Agricultural Society of England, *Journal*, 16:411–502 (London, 1855).

[24] Quoted in *Records of the Rothamsted Staff, Harpenden*, 4:12, 13 (February 1933).

	Dry substance of food consumed		To produce 1 lb. increase			Dry matter excreted
			Lawes and Gilbert	Modern figures[25]		
	Per head per week	Per 1,000 lb. live weight per week	Live weight	Live weight	Carcass weight	Per 1,000 lb live weight per week
Oxen	146.25	121	13.0	12.3 to 14.5	15.2 to 15.4	50
Sheep	20.5	159	9.2	7.3		54
Pigs	48	270	4.8	3.2 to 4.5	4.2 to 5.2	63

The most striking part of the feeding investigations, however, was the determination of the chemical composition of ten farm animals in different stages of growth and fattening: a fat calf; a half fat and a fat ox; a fat lamb; four sheep respectively in store, half fat, fat, and very fat condition; a store and a fat pig. The animals were dissected after slaughter and the percentages of water, ash, fat, and nitrogen in each part were determined, and also composition of the ash. No such investigation had been attempted before or for many years after, and the results were quoted in textbooks right up to our own time.

The chemical work associated with the field and feeding experiments was done in the barn which Lawes had converted into a laboratory about 1839. The investigations made a great appeal to the farmers and landowners of the day, and on December 24, 1853, just after the conclusion of the lawsuit, a meeting of Hertfordshire farmers was held at St. Albans to organize the presentation of a testimonial to Lawes. "It was considered," the circular states, "that Mr. Lawes has for many years been engaged in a series of scientific and disinterested investigations for the improvement of agriculture generally, which has been carried out to an extent, with an attention to accuracy and detail, and at a cost, never before undertaken by any individual, or even by any public institution." The movement soon spread and became national in character: some £1,160 was collected. Lawes decided that the money should be used for the building of a new laboratory where more and better work could be done. The architect was Gilbert's brother, Charles, who certainly lacked Joseph's ability. The work began in November 1854, but it did not go smoothly. First of all there was trouble about the estimates. Then during the operations one of the walls blew down which greatly scandalized the committee; there was adverse comment about the mortar and the structural work, etc. But in a few months the laboratory was finished, and it was formally opened on July 19, 1855, the Earl of Chichester presiding. For long the laboratory was the largest and the best-

[25] For comparable tables on the results of modern feeding trials, see J. Leitch and W. Godden, "The Efficiency of Farm Animals in the Conversion of Feedingstuffs to Food for Man," Imperial Bureau of Animal Nutrition, *Technical Communication 14*, p. 29–41 (Aberdeen, Scotland, 1941).

known agricultural laboratory in the country. It consisted of one large, high room surrounded with a gallery and with several smaller rooms running off it.

Unfortunately the barn laboratory was pulled down—quite unnecessarily, as it was in no one's way. But Lawes had no feeling for historical pieces, and so we lost what would have been a priceless relic of the early days of agricultural science.

While Gilbert was still carrying on the controversy about the source of nitrogen for vegetation, Lawes was planning attacks on various important practical problems. One of them was the manurial value of foods consumed by the animal. Knowing the increase in live weight, and assuming its composition to be similar to that of the animals analyzed, they were able to say how much of the nitrogen, phosphorus, potassium, etc., of the food was retained by the animal and how much was excreted with the manure. First, however, they had to determine whether there was any loss of nitrogen as such during digestion. Experiments in 1854 with pigs watched day and night so that their excreta might be collected showed a considerable deficit, but the technique was recognized as unsatisfactory. In further experiments in 1862 made with fuller precautions, the deficit was much smaller and justified the view that all the nitrogen not stored in the body or secreted as milk passed out with the manure. But it was very liable to loss, and Lawes and Gilbert assumed that in practice 50 percent of the nitrogen voided by the animal would be lost during the making and storing of the dung. It is typical of the shrewdness of Lawes and Gilbert's estimates that this figure still remains as the best we have. Appropriate assumptions were made for potash and phosphate, and a table was drawn up showing what compensation should be paid to an outgoing tenant for the manurial value of the food he had fed to his animals during the final period of his tenancy. In order to test the value of the table in practice the Woburn experimental farm was started in 1876.[26]

Another aspect of the nitrogen problem was developed from 1870 onwards. Measurements of daily rainfall had been taken since 1852, and periodical determinations of ammonia and nitrate made. In the drought of 1870, this work was greatly extended and put on a more permanent basis: the drain gauges were set up in Barnfield, and the large rainfall gauge established. The purpose was to determine the nitrogen and chlorine in the rain water and in the drainage water, and also to discover how much nitrogen is brought down from the air and how much is washed out from the soil during the year. Regular determinations did not begin till 1877, when Robert Warington did the analyses; they were continued from January 1888 by Dr. N. H. J. Miller who was appointed expressly for this work and who continued until his death in 1915.

The period 1860 to 1870 was busily occupied with a number of inquiries of great practical importance: the application of sewage to land; whether anything was gained by malting barley before feeding it; the value of silage; and the

[26] For the history of the compensation problem, see E. John Russell and J. A. Voelcker, *Fifty Years of Field Experiments at the Woburn Experimental Station* (London, 1936).

closeness of milling. The great advantage of applying sewage to grassland was demonstrated; the absence of any gain in feeding value as the result of malting; the failure of ensiling to increase the digestibility of the fiber, and its small advantage as compared with haymaking; and the superior value of white over whole-meal bread.

The period 1855 to 1875 might well be called the Golden Age of Rothamsted. Lawes and Gilbert had amassed quantities of analytical data and set them out in a series of papers which have become classic and remain the best we have on their subject. British agriculture was at the height of its prosperity: the towns were expanding, people were demanding more and better food, and overseas supplies were not yet sufficient to affect prices seriously. British farmers were doing well and anxious to do better. They had proved the advantage of using artificial fertilizers and looked up to Lawes and Gilbert as faithful friends and sound advisers.

After the disastrous harvest of 1879, a decline set in, and for the rest of the century, British agriculture became more and more depressed. Fortunately Rothamsted did not stagnate. In 1877 a younger worker, Robert Warington, came into the laboratory, having a different outlook and opening up an entirely new subject. Analysis had shown that the ammonia supplied by the fertilizers and manures did not long remain in the soil but was quickly changed to nitrate, in which form it is taken up by plants. This discovery threw new light on plant nutrition. The various nitrogenous substances which acted as manures were not direct plant foods but only the raw materials out of which the plant food was made, and the process consisted in first producing ammonia and then converting this into nitrate. This was apparently the same as the well known nitrification process, whereby nitrates had for many years been manufactured for gunpowder. It certainly was not a simple chemical reaction, and how it came about in the field was not known. No ordinary chemical or physical change would effect it.

Then a new agent was discovered. Louis Pasteur, the distinguished French scientist, showed the existence of many kinds of living organisms far too small to be seen by the naked eye but having extraordinary powers of multiplication, and able to bring about remarkable changes which even chemists could not effect. Two French chemists had just shown that the formation of nitrate in the purification of sewage was brought about by micro-organisms, and Warington's first task was to see if this were also true of the soil. He found that it was and thus revealed a new wonder to the farmers of his day. The feeding of their crops was dependent not only on their efforts to supply the raw materials of the food but also on the activities of vast numbers of micro-organisms living and working in the soil—their friends and allies though they had never known it. Warington worked out some of the more important of their effects, and more important still, made agricultural scientists realize their significance in agriculture. Unfortunately Gilbert could not work with Warington, and tolerated him in the laboratory only so long as Lawes remained in close association with the work. After a long and bitter period of estrangement, Warington had to leave in 1890.

This was the last important work done in Lawes and Gilbert's time, and from 1890 to 1901 there was a period of little activity. Both men were getting old; they had no young men around them; agriculture was too depressed to be attractive; and agricultural science made little appeal at the universities. Lawes, however, still kept his faith in it and was determined that the work should continue. Accordingly in 1889 he set up a trust called the Lawes Agricultural Trust and endowed it with £100,000 for the purpose of carrying on agricultural experiments, wisely making the terms so wide that no limitation of work need arise whatever direction science might take in the future. In order that the classical experiments might be continued he gave to the trust the use of the fields on which they were conducted, 52 acres in all, at a peppercorn rent for one hundred years.

In 1893, the station celebrated its jubilee, when a distinguished gathering assembled at Rothamsted to do honor to Lawes and Gilbert, and addresses were received from many agricultural and scientific societies, one of the most treasured being that from the subscribers to the Jubilee Fund. It was signed by the Prince of Wales who afterwards became King Edward VII. Shortly afterwards Gilbert visited the United States to give a series of lectures on the results, and these were published as a bulletin by the United States Department of Agriculture. The Highland and Agricultural Society also published them in slightly different form in its journal for the same year.[27]

That was the last publication by Lawes and Gilbert. A few papers were published by N. H. J. Miller on the ammonia and chloride content of rain and on certain changes occurring during the storage of mangolds, but for a time Rothamsted ceased to play any active part in the development of agricultural science.

THE BEGINNING OF THE MODERN PERIOD, 1902–1912

Lawes died on August 31, 1900, and Gilbert on December 20, 1901. There was no successor at Rothamsted itself, but A. D. Hall, the principal of the Wye Agricultural College, was persuaded by the Committee to give up his very successful career there and become the new director. In a characteristic account of his impressions of the place, Hall confessed: "my heart sank when I did come to take possession of the laboratory . . . how much more like a museum than a laboratory it was," and then referred to "the mellow dustiness that radiated from the vast stove occupying the centre of the room."[28] But he turned to and put the place into shape, and attracted a group of keen young men who brought

[27] Sir Joseph Henry Gilbert, "Agricultural Investigations at Rothamsted, England, during a Period of Fifty Years," U. S. Department of Agriculture, Office of Experiment Stations, *Bulletin 22* (Washington, D. C., 1895), and "The Rothamsted Experiments; Being an Account of Some of the Results of the Agricultural Investigations Conducted at Rothamsted, in the Field, the Feeding-Shed, and the Laboratory, over a Period of Fifty Years," Highland and Agricultural Society of Scotland, *Transactions* (ser. 5), 7:11–354 (Edinburgh, 1895).

[28] Sir A. Daniel Hall, "Rothamsted, 1902–1912," *Records of the Rothamsted Staff, Harpenden*, 1:7–9 (June 1929).

life and activity into these haunts of ancient peace; soon there began to develop a vigorous school of research.

Up to Hall's time, agricultural science had been regarded in Great Britain as a branch of chemistry, and the Rothamsted laboratory had been entirely chemical. Hall's sound field instinct made him realize that the growing plant and the soil were far too complex to be studied from one point of view only. Gradually he secured the cooperation of a botanist, W. E. Brenchley, a bacteriologist, H. B. Hutchinson, a soil chemist, the writer, and later an organic chemist, W. A. Davis, and he welded these workers and their associated postgraduate students into a team approaching the problems of plant growth from different standpoints, yet never losing touch with one another. Hall developed the subject of soil analysis which had been started some twenty years before by Bernard Dyer in a masterly investigation, but he did not leave it simply as an instrument for advisory work. In conjunction with the present writer he carried out a survey of the soils of Kent, Surrey, and Sussex which showed some of the fundamental relations between the properties of the soil and its origin on the one hand and its utilization on the other. Further, he made important studies of the relations between the growing plant and the soil.

As an experienced teacher he saw the enormous educational value of the Rothamsted field plots, and one of his greatest achievements was to summarize the results and put them in a form in which they could be used by farmers, teachers, expert advisers, and research workers. This summary remained the standard presentation of the results up till quite recently.

This recognition that agricultural science is not merely a branch of chemistry but is linked up with other sciences, and the widening of the program thereby involved, soon led to demands for more facilities and assistance. The work was no longer canalized in one direction as in Gilbert's time; each worker was striking out in his own line. The bacteriological investigations of Hutchinson and the fertility studies by the present writer called for more materials and help, and Hall set himself the problem of finding both. The Goldsmith Company started the expansion in 1907 with a munificent donation of £10,000 for additional endowment, but it soon became clear that much larger resources were needed.

Throughout Lawes and Gilbert's time the whole cost of the work had been borne by Lawes. Self-help was the watchword of the nineteenth century and any idea of State help would have been anathema to the sturdy men of those times. The attitude of the Board of Agriculture was equally definite. When Hall and some of his committee approached the president for a government grant, they were severely told to go and collect the money themselves if they wanted it. Later the secretary confided in Hall his view that agriculture in England was dead and that it was the Board's business to bury it decently. Fortunately this pessimistic view did not long prevail. By the early years of the twentieth century, it was realized that to allow agriculture to perish would be disastrous. David Lloyd George as Chancellor of the Exchequer visited Rothamsted and shortly afterwards (1911) set up the Development Fund for the

rehabilitation of British farming, appointing Hall one of the commissioners to administer the fund. The money was not to be used for subsidies or for bolstering inefficient farmers, but for improving the methods so that farmers could themselves improve their position. An entirely new principle was to be introduced into British administration. For the first time the development was to be based on scientific research, the results of which were to be carried to farmers through advisory and educational agencies. Help was also to be given for the establishment of new branches of industry, for land reclamation, and for other activities. It was a chance such as comes rarely in the history of British agriculture, and Hall accepted it and threw himself into it with his accustomed vigor.

For a time Hall remained at Rothamsted as director, but he was called off more and more to London and elsewhere and finally had to choose between the two posts. He elected to retain the commissionership and to give up Rothamsted. He left in October 1912 and was succeeded as director by the present writer.

CHARLES MANIGAULT'S ESSAY ON THE OPEN PLANTING OF RICE

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INTRODUCTION

Among the Huguenot settlers who found refuge in the Carolinas was Pierre Manigault from La Rochelle. His descendants prospered with the expanding economy of the eighteenth-century plantation area which developed along the banks of the Cooper, Ashley, Edisto, and Santee rivers near Charleston.[1] However, by the 1830s, this once fertile region was beginning to lose its dominant position in the agricultural life of the Palmetto State. The successful growth of upland cotton, the extinction of the indigo industry, and the exhaustion of both timber and soil in the low country contributed to this shift. A natural sequel was the purchase by Carolina planters of tidewater swamplands in Georgia and Florida, which held out prospects of successful rice culture.[2] These were not only virgin lands which had yet to be "butchered" by the traditional American methods of thin plowing, no fertilizing, and precious little rotation of crops, but they also were blessed by a river system whose waters conveniently overflowed with precision comparable to that of the famous Nile. Yet, many Carolina planters did not give up their attempts to wring a respectable crop from their thinned and powdered soil on the old plantations. They tried a variety of experiments such as fallowing the land by omitting one crop in four. New types of seed were brought in, but the change which seemed to offer the greatest possibilities of advantage—although distinctly a gamble—was a new method of planting variously called open planting, open-trench planting, or planting with clayed seed.[3]

[1] For the careers of four members of this South Carolina family, see the *Dictionary of American Biography*, 12:233–236 (New York, 1933).

[2] The rice-growing area began to expand down the coast at least four decades before the 1830s. See L. C. Gray, *History of Agriculture in the Southern United States to 1860*, p. 279–280 (Washington, 1933). However, the large-scale movement of Carolina planters into Georgia was in the later period.

[3] The literature on this attempted resurrection of South Carolina rice culture is extensive. The *Southern Agriculturist, Horticulturist and Register of Rural Affairs* (Charleston, 1828–1846) contains numerous letters, editorials, and reports on this movement. The most valuable observations on open planting, fallowing, etc., are found in the so-called new series which ran from 1841 to 1846. In volume 1, pages 80–81 (February 1841), the editor, J. D. Legare, included a succinct comparison of open-trench and covered planting. In volume 3, pages 241–246 (July 1843), the report of the Committee on the Cultivation of Rice, read by Governor Robert F. W. Allston to the State Agricultural Society of South Carolina in December 1842, was reprinted from the *Southern Planter* (Richmond, Va.). This account describes the three methods of rice planting and culture—covered or trench planting; water culture, meaning water on the fields for 150 of the 180 days necessary to grow a crop; and open planting with clayed seed, an invention attributed to Captain John H. Allston in 1826.

The following essay was penned by Charles Manigault of "Silk Hope," South Carolina and "Gowrie," Savannah River, Georgia. He was a direct descendant of Pierre Manigault and a substantial citizen of the proud city-state whose capital was Charleston. He was one of the few planters who tried both "escapes" from economic ruin, namely experimentation and purchase of Georgia lands. The pages which follow show also that he went further and actually used the results of Carolina "scientific" agriculture to boost the production on his new lands. Thus, this readable summary of his experience with open planting in both Carolina and Georgia is unique in that, in addition to containing detailed instructions as to preparation of land and seed, watering, and hoeing, it is also a report on the trials and tribulations as well as the harvest which was awaiting those planters whose vision, energy, and resources would enable them to combine open planting with the cultivation of the rich, firm clay laid down by the Georgia river system. However, when the essay was composed in 1852, its original purpose was to provide enlightenment and instructions for the overseer of his Savannah plantations as well as for the edification of young Louis Manigault who was serving as his father's representative in Georgia. The original manuscript is preserved in separate pages of closely written script which were tucked between the covers of Louis Manigault's Plantation Diary, the very same journal which was used by Professor Ulrich B. Phillips for many of his observations on the growing of rice.[4]

The usual tide-flow system, as it developed in the Carolina-Georgia region before 1830, is briefly outlined by Professor Phillips in his *American Negro Slavery*.[5] This method required a series of short flowings and hoeings every few days during the first half of the growing period, to be followed by a long "lay-by or harvest" flow of from two to three months. Convenient and regular tides as well as an abundant labor force are obviously necessary for the successful operation of this system. In his *Life and Labor in the Old South*, Phillips hinted at the existence of the practice of open planting but did not seem to sense the background of agricultural decline and experimentation which had produced this variation in the culture of rice.[6] It may well be that he was relying too strongly on the writings of Governor Robert F. W. Allston whose many published studies of rice were often confusing, vague, and even contradictory in matters of detail.[7]

[4] Ulrich B. Phillips, ed., *Plantation and Frontier*, 1:134–166 (*A Documentary History of American Industrial Society*, Cleveland, 1910); *American Negro Slavery*, 247–259 (New York, 1918). The Manigault Plantation Records, 1833–1887, 5 volumes, are in the Southern Historical Collection of the University of North Carolina at Chapel Hill. They were consulted by the writer in July 1941 in connection with a study of "Rice Plantation Management in Ante-Bellum Georgia," which he is making with the assistance of a grant-in-aid from the Social Science Research Council.

[5] *American Negro Slavery*, 89–90.

[6] *Life and Labor in the Old South*, 115 (Boston, 1929).

[7] In his *Plantation and Frontier*, 1:259–265, Phillips reprinted certain excerpts on rice from Governor Allston's essay on "Sea-Coast Crops of the South," which was published in *De Bow's Review* (New Orleans), 16:589–615 (June 1854). See also *De Bow's Review*, 1:320–

The essay by Charles Manigault should serve to clarify the whole question of how and why open planting of rice was resorted to by the Carolina planters. His habit of underlining significant words and phrases will serve as a guide to the neophyte who is without any knowledge of the routine of an ante-bellum rice plantation. From the standpoint of organization this summary of the advantages and disadvantages of open planting is a masterpiece. The historian of American agricultural techniques, the student of the evolution of the plantation system, and the economic analyst of the management problems confronting the planter capitalist in his use of soil, tides, and labor will all learn something from this synthesis of Manigault's quarter-century of experience with open planting in Carolina and Georgia. Among other items they will see that this method saved labor but complicated the problem of keeping a static slave-labor supply busy so as to cut down overhead expense, and also that if successful it produced the need for a greatly enlarged labor force at harvest time. The advantages are also patent, in that labor was saved, the yield was increased, and grass, volunteer rice, and May birds were discouraged. Again, it shortened the period from planting to harvest by two to three weeks, which, in turn, allowed for later plowing and planting and thus permitted the handling of more acres by a small labor force. Finally, due to the increased yield of the staple crop and the lessening demands on the labor force, as well as "cleaner" fields, more lands could be used for dry culture to raise much-needed provisions and thus cut down cash outlay for food.

RICE CULTURE, By *OPEN-PLANTING*, *on Savannah River*
July 1852

The Ditches, & Quarter drains, having been dug out & cleaned Banks made up, &, The fields are thoroughly ploughed & harrowed, and *the later* this *ploughing* is done in the spring *the Better*, *Because* late in the spring the Volunteer Rice has pretty much sprouted, & attained considerable height, & strength.[8] And *late Ploughing* turns *all this*, *& the Grass*, *upside down*, from which all the volunteer which has sprouted *Cannot recover*. There are but few of us however (and I am not among those few) who can defer *all their ploughing to a late period in the spring*, as the ploughs of mules on our swamp Plantations (where there is not an inch of high land) are few, & *I* must begin in January with 3 or 4 Ploughs, or I cannot get thro' turning, & harrowing 650 *Acrs* before the month of May.[9] Our Rice fields are *all* more or less polluted with Volunteer Rice, and as *this* is the greatest Difficulty we have to contend against, I will refer here to *the Cause* of this Difficulty, and to *how* this is added to annually, & perpetuated as a concomitant characteristic of our Rice Culture—the *evil being renewed* every harvest, by the Quantity of Rice which falls

356 (April 1846); 4:502–511 (December 1847); R. F. W. Allston, *Memoir on the Planting of Rice* (Charleston, 1843); and the files of the *Southern Agriculturist* mentioned in footnote 3, above.

[8] In preparing the transcription for printing, special care has been taken to follow the capitalization, spelling, and punctuation of the original text.

[9] Louis Manigault's "Plantation Diary" for 1860 lists the combined acreage of the "Gowrie" and "East Hermitage" plantations on the Savannah River as 650.

in the fields, not only from the Volunteer Rice, which sprouting first, always ripens first, and *thus* much *of it* falls again in the fields before the crop is Cut—*besides which*, portions of the *over-ripe Crop itself* during the rough & hurried process of harvesting—and in the anxiety of the Negroes to hasten & deposit in the Flats[10] their respective tasks of shieves, piled up on their heads—who often jostling & knocking against each other, in their hurry & hilarity they scatter, & trample on, the ripe Grains thus profusely cast upon the soil—where they remain until early spring calls forth this spontaneous growth of Volunteer Rice—there still being a large portion of this Volunteer seed buried every winter so deep in the soil by the feet of Cattle, & mules, who on most Plantations are turned all winter on the rice stubble—and this latter portion of Volunteer Seed *will await for Years* some turning of the land, which will bring it near enough to the surface to sprout and this state of Dormant Vitality is astonishing at times—as it is well attested that Grains of Rice will remain 20 years & upwards, beneath *too great a depth* of water, or *too far below* the surface of the earth to germinate, but still preserving its Vitality for some favorable season to germinate, & start into life—(But what are 20 years suspended animation in a Rice field, *when compared with* the Bulbous Roots—(Wheat, &,&,) embalmed for 1700 years with the Egyptian Mummy's—*which after this period* were planted, & grew.

The principal Disadvantage of Volunteer Rice, which so infests our fields, is that after the first year of its spontaneous growth, *it turns Red*—and *never turns White again*—on the Contrary, from year to year, it becomes of *Still Deeper Red*—and all that any Single Red Grain produces *is perpetually Red*. And this mixture of Red with our beautiful White Grain is objectionable to Purchasers, who make a Complaint of this, to detract from the Rice in hopes of buying it cheaper. It really *is anoying* to observe in most of the Stacks in our Barn Yard Quantities of Volunteer mingled with the shieves of pure white Rice, all harvested—Cured & here stacked together, and about to pass thro' the thresher together. Some Planters separate the Volunteer from each Sheaf in the Barn Yard. But I never could attempt it, for the hurry of threshing equals the hurry of harvesting—and I have a Steam Thresher which is so powerful that the shieves pass up the inclined plane, & go through the great Iron Beater three shieves abreast, without *untieing or Cutting the bands* of a single sheaf. To eradicate Volunteer Rice from our fields, seems impossible, for the evil is renewed each year. But when the field can be spared from Rice Culture for a Year a *Crop or two of Dry Culture* (one of Oats, & one of Pease in quick succession on the same field and during the same summer) *is very effectual* in destroying Volunteer Rice. For after turning & flowing the field to sprout the Volunteer the luxurience of the Dry Culture crops *is sure* to smother all that has sprouted in these fields. But *some of us Cant* spare our fields for Dry Culture and *our only plan is* to plough *late*—& turn the Volunteer Rice *up side down*.

Generally, Rice is planted on all Rivers so as to avail ourselves of the high tides during the full & change of Moon, for ensuring a good & deep flow *at once* on the newly planted fields. *For this reason* I have known *some Planters* on *our river* to commence *their planting* as early as *the last days of February*, because *the high tides served then* & would not again for two weeks. But *this* is *too early*. The Rice planted thus early has to be Carefully Covered in the trenches with earth (of *this*—as well as of *open-planting* I shall state below some facts, proceeding from *my own little experience*) on Sav[anna]h River by planting

[10] A flat-bottomed boat of shallow draft, ranging from 20 to 30 feet in length, square at both ends, narrow enough for use in the canals of the rice fields as well as on rivers, and usually manned by from two to six slaves.

24 crops.[11] Rice planted at this very early period, is slow to germinate, and seldom sprouts healthfully, or uniformly in the cold water of this early season, and when the water is drawn off, the delicate Young Crops on these early planted fields are very apt to be injured by the March & April frosts, when at this period Caught by cold weather, while unprotected by a flow of Water on it, &c. But, to shew the process of Culture with some of us on Savannah River, let me glance at my own Operations there this season—viz.—Having prepared the fields by ploughing, Harrowing, & trenching (the Seed having been carefully Clayed)[12] two Bushels of Seed Rice to the Acre were planted without Covering in three fields (in all about 50 Acres) when the trunks being raised, the water flow'd in *carefully*, so as not to dislodge any of the Seed in the trenches, until these fields had an average flow of about 1½ foot of water—*this* was on the 20th March of 1852. And *this flow* was kept on until the 10th April, Being thus *flow'd 21 Days*.[13] It was then drawn off gradually, and Kept Dry—15 Days[14] bringing it up to the 25th April, to let the Young Plants (which were now on an average 2 or 3 inches high, & all turning green) have the benefit of the sun, & air; to give them strength—for on drawing off this first 21 days flow the young Rice which has thus been streatched up by water is very apt to look Delicate for the few first days, sometimes thin-sickly—& of irregular height. But *my soil* on Savannah River is *so strong*, that this Young Rice after a few days of *apparent weakness*, is almost sure to assume a healthy, flourishing aspect, altho' even *this* flattering appearance has after a while proved delusive; *for some of my Neighbours* (on the Carolina shore of Savannah River) *Condemn* this open-planting *as often turning out a failure*, & not a plan *You Can ever feel Confident in*, or *calculate upon*, that *with them* the Rice never recovered from the *early forcing*, and it is certainly well understood with Cooper River lands for instance, that in all *poor*, or *worn out soils*, Rice *thus weakened*, & *streatched up* by a long continued flow, *cannot Recover*. BUT LET ME CONTINUE.

My 50 Acres of Rice having Now been Dry from 10th April to 25th, 15 Days, During which 15 days *on account of volunteer Rice, one Hoeing is very important Now*, after which

[11] There is some discrepancy here since all available evidence in the Manigault records give 1833 as the date when Charles Manigault first bought rice land in the Savannah River region. Thus by 1852 he would have planted no more than 19 crops.

[12] The description of one method of claying the seed in the *Southern Agriculturist* (n.s.), 1:80 (February 1841), by J. D. Legare, the editor, is as follows: "The rice is first 'clayed,' that is, the rice intended for seed is spread out thinly on the threshing floor, and fine clay being mixed with water, to the consistency of white wash, is thrown over the rice, which is then stirred, and each grain becomes enveloped in a thin coat of clay. It is then fit for use, or may be laid by for a few days. This is only done when it is intended to sow in open trenches, for were it not done, the rice would float as soon as the water was put on, but being coated with clay, it retains its place in consequence of the increased weight from the moisture imbibed by the clay." Local tradition in Georgia supplies another version of the claying process; seed, clay, and a little water were mixed in a barrel, which was given to one of the older yard slaves or even one of the younger female slaves, who proceeded to roll it continuously for a number of hours until the clay had stuck to the seed.

[13] The first flow of 21 days was from three to four times the length of the usual "sprout flow" of the older "covered" method. An averaging of the length of the "sprout flow" as recorded in the Plantation Journal of Hugh Fraser Grant of "Elizafield," Georgia, in the possession of the writer, shows the first flow was usually from 5 to 8 days. See *Agricultural History*, 13:208–217 (October 1939).

[14] According to the Hugh F. Grant Journal, 11 days was the longest dry period allowed after the first drawing off of the water.

it was flow[e]d again until the 15th May (making 20 Days) to freshen & streatch it—and now on the 15th May these 50 Acres had all the water again drawn off, with a view of giving the crop the benefit of Manual Culture, the Negroes being *now* turned into these fields for the first time since planting them except the light hoeing in April to subdue the volunteer Rice, which if clear of Volunteer could have then been let alone. Not a single Negro having *as yet* been called on to do an hours work here, two months having now elapsed since putting the seed in the ground. And now these fields are kept dry for 40 days, during which period, the Rice is howed twice,[15] at an interval of 3 or 4 weeks to each field—the alleys between all being rendered clear of grass & weeds—the rowes of Rice all picked clean of grass, &c., and the Crop being strengthened in growth, & duly advanced, *Now* about the 1st July the Joint Water, or Harvest Flow is placed upon every field in succession (as fast as they are *duly prepared, & ready for this flow*) and continued thereon (with a little freshing, flow occasionally) up to the period of the crop's being (in succession) Ripe, & ready for harvesting—this last & long flow, having been steadily maintained, so that each field has had from 6 to 8 weeks, viz. from the beginning of July to the latter end of August, at which latter period the sickle is very generally found actively at work in our harvest fields on Savannah River. Altho I remember on one solitary occasion (I think in 1835) General Hamilton['s], Overseer, a Conceited fellow named "Evans" wishing to shew off in the neighbourhood, & professing to know more about Rice Culture *than any one else, he* commenced harvesting on the 11th day of August of that Year, on our River.

The whole of my crop this year (500 acres) is Open Planted, and *this mode of Culture*, particularly in the early stages, requires *close watching, & considerable judgment & experience* to ensure success—as its satisfactory progress depends very much, thus far, on the weather's having been Cold & Blustering or Mild & Seasonable—for when this first water has been on the field 21 days, if the weather has Continued Cold the Rice will have advanced *but very little—when this flow* (under some anxiety & fear), must be continued a little beyond the 21 days. For with this first planting, should *cold weather prevail, cold water is not the thing* for Rice to flourish in—and to judge daily of the condition of things in these open planted fields the Planter, & more particularly the Overseer makes it a point to go every day with the Trunk Minder who waides into the field & brings back a handfull of earth with the Grains of Seed Rice in it—which tho puzzling to the Novice, shews at once the experienced Open-Planter what is now best to be done, &c.—And under the probable occurrence of a Cold Spring having retarded the first planted fields, should this cold water be now drawn from this Young Crop after 3 weeks immersion, the white sprout, & tender root will shew but little progress, & be still in a dangerous position—with *the Sprout* feebly developed—& *the root* not having as yet sufficient strength to turn down & take firm hold of the earth—but having the whole of the rows exposed to view twisted-delicate, and inclined to grow Crooked—and thus left to penetrate the soil with its own enfebled force—which thus far it has not strength to do—from a backward season, or from the season having been too early, & too cold to plant open—instead of protecting the seed by covering. And now Comes *another Difficulty* in *Open planting* if under *the state of things alluded to above*, the fields be Dried *by accident*, or *Design*, exposing the young Crop in its precarious Condition to a *Hot Sun, a frost*, or to a *piercing Wind*, either of these will inevitably destroy Much or if on the Contrary towards the end of this 21 days, flow, should the Rice (owing to warm weather) have shot up rapidly to 3 or 4 inches in

[15] This would make a total of three hoeings in all; most planters, using the older methods, had to hoe the fields four or five times.

height, and a Storm, or windy weather occur (while *the flow is still on the field*) this will agitate the water covering this delecate young Rice, & *disengage* much of it from its original position in the trenches (where it was planted without covering) and cause some of it *to float away to leward*, and lodge against the sides of the Banks in each field.—And while a portion of this Young Rice is thus found floating, the only remedy is to slack the water down *immediately* nearly to the roots of this Young Rice, so as to let any portion of it disengaged by the Winds, or Storm, take fresh root again in the trenches. *Moreover* this *letting off water* is always *a dangerous thing* for in slacking down—or drawing the water off your fields, *tides may be running lower & lower every day*, or an adverse wind for a day or two may blow down what would otherwise have been a good tide—and you thus cannot get the water back again from the river on your fields, perhaps for several days,—*when if a hot sun prevails it may* destroy the Young Rice whose delicate roots have not as yet taken sufficient hold in the Soil, and now lie exposed, not only to the action of a powerful Sun by day—but the withering winds of Chilly Nights, which sometimes occur in March & April, May also prove injurious, &c, &c, &c. *So that* during the first month or six weeks we are *Always anxious* about Open-planting—for the grains of Rice in the trenches being uncovered, & unprotected *by any earth*, wild ducks dive down night & day, and eat a portion of the Seed Rice—While on the high places in the fields the Crop being dry, or nearly so, and in full view of Black Birds, & others, who evidently think it was planted expressly for them—they devour quantities of this valuable seed Rice, in spite of Bird-minders, or their Guns. *All these things shew* that OPEN-PLANTING *is a dangerous thing.*

What then are the Advantages of *Open-planting?* Formerly in Rice Culture the Seed when planted was I believe always covered with earth, previous to flowing it—and *this plan* is adhered to still by the majority of Rice Planters. But in *Covering Rice* the same earth drawn aside in digging these trenches is thrown back again on top of the pure Seed Rice, which is always saught after, & selected most carefully by Planters, on account of its large Grain, and the absence of Red Rice (or Volunteer) from it—Seed Rice being often brought from a Distance, & generally at Considerable expense. I buy *a portion* of Seed Rice every year, & have generally paid $1.50 per Bushel—besides paying for two voyages, viz. from Georgetown to Charleston,[16] thence to Savannah, to which I send my flat for it. But I only plant each year 30 or 40 Bushels of this fine seed, which yields me sufficient (say 1000 Bushels) to plant my entire crop the ensueing year.

It is thus evident that *in pursueing the old plan* of *Covering Rice*, all that is *impure & objectionable in the Soil*, its Volunteer Rice, its Grass Seeds, roots, &c, become thus *blended*, & *actually Cultivated with* the Pure, & often expensive Seed Rice—so that

THE FIRST ADVANTAGE OF OPEN-PLANTING is that the trenches are made (no doubt down to a purer soil) & the seed so specially selected, is dropt carefully in these trenches, & thus in Open-planting *nothing* but *the pure, fertalizing river water*, to the depth of 1 or 2 feet, now Covers the Seed Rice, by which process, all Volunteer—all rank and unwelcome vegitation, is, to *a very great degree*, Confined to the alleys betweene the rowes of pure Seed Rice, which impurities in the process of hoeing between the rowes of Rice are cut down, and destroyed with the hoe, &c.

Second Advantage of *Open Planting.* The *time*, & *labour*, of covering Seed Rice with a Wooden Bat in the hands of each Negro *is saved* in Open Planting, and the fields are all

[16] Georgetown, about 60 miles northeast of Charleston along the coast, was the center of a region which produced a brand of seed rice reputedly the best in the country.

flowed with *less delay*—for all "Delays are Dangerous" & uncertain, when water from a tide river is required to flow a Rice field. For too often you cant get it when You want it.

Third Advantage of Open-Planting is that for a length of time after putting the seed in the ground the Negroes have *no call whatever* to work, or attend to, those Open-planted fields—as the first Stages of those crops are urged forward, & entirely Cultivated *by water*, by which the planter *thus* finishes a greater Quantity of Work, in a much shorter period, and thereby turns his back upon (as a thing Done) so much more planted land than he could possibly have accomplished under the old mode of Culture, which now by this modern mode of "Water Culture" he will not be called on to work at for at least two months after planting it. Whereas, in the old plan of sprout & point flow, with two flowings, and two Dryings, in the first 3 weeks, we are generally called on in the 4 or 5th week to turn in with all our force to hoe grass—which latter by this old process *has been cultivated, as well as the Rice*, and it is sure *to keep pace with it*—and *if let alone* for *a very few weeks*, this Grass in a rice field *which has been covered* is sure to overwhelm the crop.

Fourth Advantage of Open-planting is that the Rice in Germinating, having no Soil to pierce through—pushes forward more rapidly, and all the substance in each grain of Seed Rice is *thus* sooner exhausted by being more rapidly converted into root & sprout—by which the seed *at a much earlier period* no longer offers any inducement to Ducks—Birds—Rats—or Insects of any kind to disturb, or devour it.

Fifth Advantage of Open-planting is that the Crop is advanced with such activity, that *in one month* it will compare in size & in all other respects, with Covered Rice of *Six Weeks growth*. Whereas in covering Rice the Crop frequently Comes up irregularly & any grains under a sod of earth—or in any way too deeply buried, will not germinate—but rot there—if water is kept on it long.

And Lastly the Open-planted Rice by starting so immediately into life, & growing so rapidly by being immersed during 3 weeks, has the field *entirely to itself*. Nothing but this aquatic plant *can sustain itself* under this deep & protracted flow. And in *drawing off* the water *No Grass or Weeds whatever* are found *growing in the same field with it*—which fields when this 21 days water is drawn off shews *Nothing but* the beautiful Young Rice growing upon a *perfectly Clean field*. And the Planter knowing *Now full well* that he will not be called on to hoe, or pick this portion of his Crop for 6 or 8 weeks—these are certainly important results *in favor of open-planting*. I was conversing with one of the largest Planters near Georgetown "Mr. Chs. Alston" who informed me (this 22d June 1852) that all the Planters in his neighbourhood (with scarcely an exception) now plant their 2d & 3d planting *Open*.[17] The 1st planting they always cover, because they are to the north, & it is there too cold to plant *their first open*. They have Clay lands too which are known to be stiff-tenacious, & of a Cold nature, Compared with looser soils—& Mr. C. Alston informs me that the Open-planting *he & they all highly approve of*, & all of them resort to it as soon as the mild weather sets in—and I need not remark that Georgetown & its neighbouring Rivers produce the best Rice in the World. *We all look up to them*. But, after all is said, I must Conclude by observing with regard to Open-planting that *the Doubt* and *uncertainty*—the *anxiety* whether one will *ultimately* have *a good stand—or not*—by which in open-planting one is tantalized for a month—or six weeks after putting the seed in the ground *are all much against this mode of planting*.

[17] Note that the author was writing some ten years after Governor Allston's first description of rice planting in Carolina which does not suggest that the planters had any favorite method of planting. Thus, it seems that open planting had grown in popularity in the decade.

BUT IN ITS FAVOR AGAIN I MUST SAY that formerly I thought I had been doing *great things* for *a series of years past* in planting 10 Acres to the hand, partly in Open-planting, but principally by covering—*But Now several of Us* in my neighbourhood on Savannah River *know full well* & candidly acknowledge that *with this Water Culture we can Plant & bring to Maturity* 20 ACRES TO THE HAND.[18] BUT we could not pretend to harvest it with the same small force. But would require this force to be Doubled at least ere we could at a reasonable period get this Crop safe in the Barn Yard.

The Old Plan of Planting *with us* was to cover all the Seed Rice with earth, and to put the sprout flow on during from 5 to 8 days (according to the weathers being Warm, or Cold) this flow being merely *to swell & burst the seed.* These fields are then Dried for about 10 days, until the delicate root has turned down & taken hold of the soil, & the white sprout exhibits its sharp point just piercing thro' the Surface of the field, from ¼ to ½ inch in length—And *the old plan was at this stage* to give this Young Rice the Point Flow for 8 or 10 Days which streatched it up 6 or 8 inches—When these fields were Dried again for about 2 weeks, during which it has one good hoeing to subdue the rapid development of grass & weeds. After which comes a Streatch Flow of 2 or 3 weeks duration. And then the fields being Dried again, *one & sometimes two hoeings,* & a careful picking of grass were given—This brings the first planted of the Crop up to the latter end of June, or the beginning of July, And this portion of the Crop now *should* require *no further manual labour.* It *ought to be* now perfectly clear of grass, & all ready for the long, or Harvest Flow. And with regard to the Harvest Flow, whatever may be our individual Mode of Culture—we most of us go on planting from the middle of March until the beginning of May. *This I invariably do,* Because *late planting with Water Culture Conceals & protects* the Young Rice, particularly during the very Critical period of Germination from May Birds in particular, which always Come in swarms the latter end of April, and remain prying over our Crops for 5 or 6 weeks, and should they find the fields Dry *by accident* or *design,* they would commit great devastation—And I also make it a point *to plant late* because *this admits of ploughing late also*—which as I have already Stated is the most effectual way of *Destroying* the *Volunteer Rice,* by its *Now having had sufficient time* to Germinate & sprout up pretty high, when this *late ploughing* turns all this unwelcomed Vegitation *up side down,* giving a Quietus to all that has sprouted.

And altho there are about two months between the 1st, & last planting, *still, the latest* has *the warmest,* & most congenial weather, & goes forward more rapidly—and as harvest, & all our operations *here* progress *in succession* we are sometimes anoyed by the last planting ripening too fast for us—by which it is ready for the sickle before its turn has come to be reaped[19]—and *this is Bad too,* for *over-ripe Rice* scatters its Grains in harvesting, & thus *adds to* the Volunteer Rice already in those fields—for this Reason under *Any process of Culture* it is desirable that the final long water for bringing the Rice to Maturity should also be put on *successively,* from the beginning to the middle or end of July. The great Complaint against this old plan of Covering Rice, & advancing it by this alternate process of *Short Wettings* and *Short Dryings,* in *quick succession is that Grass & Weeds* are encouraged, & equally cultivated with the Young Rice, until the Rice gets its first

[18] Compare this with Governor Allston's 1842 report in the *Southern Agriculturist* (n.s.), 3:242 (July 1843). He stated that a return of 5 acres to the hand with an additional acre devoted to the cultivation of provisions was all that could be expected of the rice lands in South Carolina.

[19] This illustrates a real problem in management as the slave system did not permit rapid expansion of the labor force.

hoeing (which does little towards eradicating it). Whereas, by Water Culture the grass is from the outset Completely kept back, & as the season, & the crop advances, it requires much less labour & care to subdue it. For under Water Culture it always makes but a feeble appearance. While this alternate *Wetting & Drying of the Crop from the first, encourages Grass,* which without great attention & labour—hoeing & picking, *will keep pace with the Rice,* and sometimes overtake it—& completely smother & destroy it. By which, if one is not sufficiently strong handed to *cultivate carefully & effectually all that one has planted* some Fields must then be abandoned—or all the rest of the crop will surely suffer. I have had to abandon occasionally one or two fields, which the Grass had already conquered, & taken possession of.—But at the same time I confess that *thus far* I have made much larger crops by this old plan of Covering than by this modern Water culture—But as I this year planted all my land 500 Acres *Open*—we will see the result.[20]

[20] The crop records of "Gowrie" in the Gowrie Plantation Book show that 946 barrels of rice were harvested in 1852. This was the third best crop from 1833 to 1860. In 1855 the crop was 995 barrels and in 1857, 990½ barrels, but there is no notation as to whether or not open planting was used in these years.

THE POLITICS OF PARITY

A Review of John D. Black's *PARITY, PARITY, PARITY*

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John D. Black's *Parity, Parity, Parity* (Cambridge, Harvard Committee on Research in the Social Sciences, 1942, xi, 367 p.) is better than its title. Near the beginning the reader is told that "parity for Agriculture alone is impossible. Parity is a balance concept—like an apothecary's scales. . . . The balance in this case, however, has three scale pans instead of two, one for Agriculture, one for Labor, and one for Capital." A few paragraphs later we read of the presumed arterial throb of agricultural spokesmen: "Parity, parity, parity—that's what the farmers need."

One may well ask, shall it be three parities for one, or one each for the big three, or a little for all,—including nonagricultural industries—so as to make every man a king?[1] This is not meant to imply that the author has a proagricultural bias. In fact, his objective analysis embracing a broad social view is in marked contrast to the provincial pleaders from whom we hear so much and learn so little about the need of special groups for higher wage rates, parity, and parity plus.

The evolution of agricultural policies since World War I is presented in a terse and enjoyable style. This background information is spiced with philosophical observations. Reading it brought back memories of college days when some professor came unprepared

[1] Incidentally, a few years ago an attempt was made within the Government to develop the parity-price concept as a basis for adjusting tariffs on industrial products, but after some study it was abandoned owing to its complexity and lack of data.

and soon launched out on generalities and experiences that were not only interesting but perhaps of more lasting value to his students.

The author observes that, "Never before have the forces of agriculture been so strongly mobilized in Congress and out." Here seems to be a prophetic implication that the pendulum may reverse its swing, for later he admonishes agriculture not to make excessive demands.

The discussion of "fragments of truth" in farmer vs. nonfarmer contentions is elucidating and worthy of widespread publicity for general educational purposes. The reviewer, for instance, after listening to a barrage of farmer complaints from a farmer in Wisconsin has found that listening to an urbanite and labor-union advocate in Minneapolis helped to restore his equilibrium.

Although the style of the book and its organization are admittedly journalistic, the professional economist may profit by reading chapter 5, on "The Evolution of Parity"; chapters 6 through 9 on prices, wages, and the earnings of labor, capital, and the farmer; and chapters 12 to 15, especially chapter 12, "Alternative Parity Standards."

On pages 49–50 the author observes that the 1933 revision lowered the index numbers of prices paid by farmers from 1925 to 1929, "because farmers were in these later years buying more of things whose prices had declined considerably—automobiles, for example." This is good logic, but the mystery of index numbers sometimes leads even a suspecting statistician astray. The time and level at which automobiles, as well as tractors and motor-trucks, were introduced into the general index-number series were such that their addition lowered the index only three-tenths of one percent in the late 1920s.

Commenting further, revisions in index numbers and the parity ratios are attributed to changes in economic facts which statisticians are powerless to affect. Such a statement may mislead those readers who accept an official index number as an incontestable fact. Perhaps few if any are more aware of this situation than the author; and also of the unusually large part that judgment plays in the predetermination of this particular index-number series.

The discussion of parity reveals how legislative changes in the parity formula have invariably boosted the parity price. The chart reproduced on page 60 shows how the extremely high price of burley tobacco in 1936 was included in a new base to boost the legislative parity price for this commodity. The story behind this change would have made an interesting addition.

At times the author speaks of the over-all ratio of prices received to prices paid by farmers (1910–14 = 100) as the percentage of parity. This is in line with the original definition of parity in the Agricultural Adjustment Act of 1933, as applied to basic agricultural commodities other than tobacco. Now that we have parity for many commodities computed from varied bases and even so-called "comparable prices" there is no figure yet available that reveals the percentage of parity prices for agricultural commodities as a whole.

Historically speaking the author observes that the share of the social income accruing to labor was relatively small from 1910–20; that agriculture was at a disadvantage in the 1920s and early 1930s; and that capital has gotten a relatively small share during the last decade.

Seldom is a book published that is more timely and that brings its subject so near to date—especially in such a fast-moving scene as the present. For this and other reasons the book should be of particular value to teachers and policy makers as well.

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